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The Geographical Journal

Vol. LXIII No. 5 May 1924

TOCANTINS AND ARAGUAYA RIVERS, BRAZIL

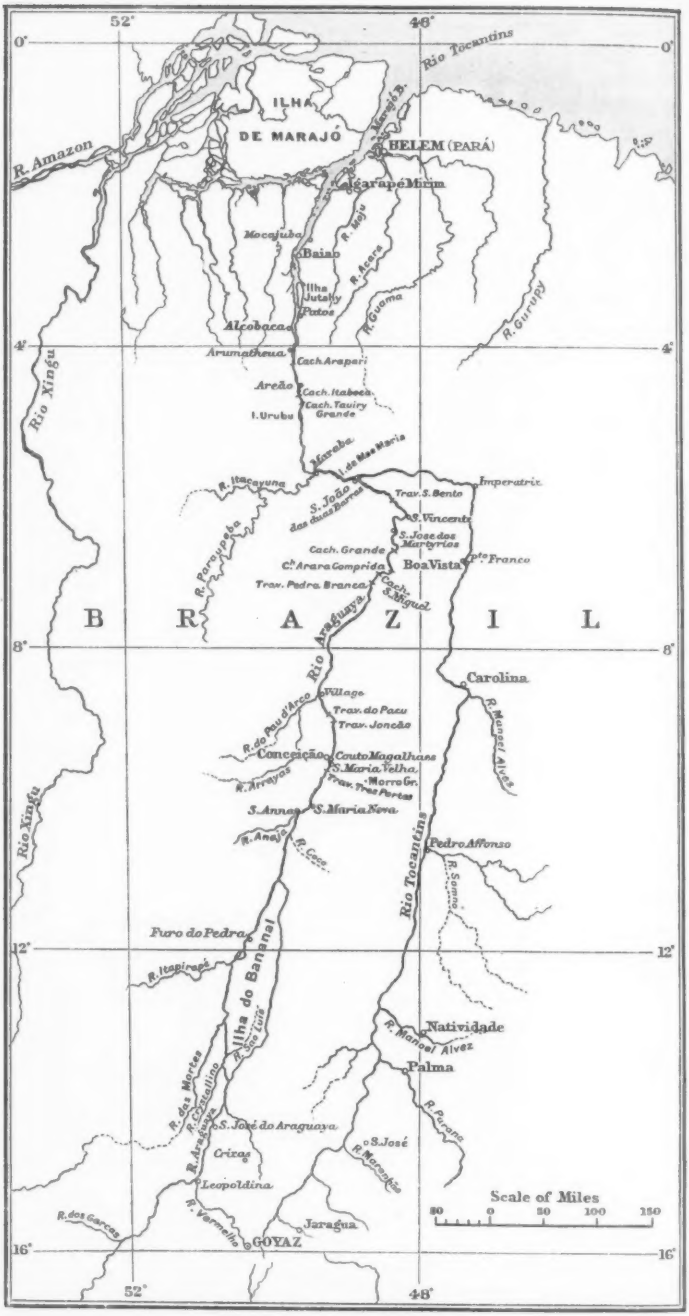
Captain S. C. Bullock, M.C., M.I.M.M.

Read at the Meeting of the Society, 28 January 1924

IN the spring of 1922, an expedition explored the Tocantins and Araguaya rivers with a view to ascertaining to what extent they were navigable and whether economic minerals existed in their vicinity. These rivers traverse the greater part of Brazil, flowing from about 18° S. until the Atlantic Ocean is reached at the equator. The city of Para (Belem) is at the mouth of the Tocantins, sometimes called the river Para, which flows into the sea south of Marajo island, whilst the true mouth of the Amazon lies to its north. The Araguaya, which joins the Tocantins some 500 miles above Para, has its source quite 2° south of where the Tocantins rises, is considerably wider, and has a greater volume of water, so that it might be considered the major river, and have its name therefore given to the mouth at Para. H. W. Bates, in his book 'The Naturalist on the River Amazons,' describes his journey in 1848 up the lower part of the Tocantins from Para to Arumatheua, and his description of the inhabitants and scenery are as accurate to-day as they were seventy-five years ago.

The party which left England consisted of Captain O'Brien, Mr. A. S. Quaife, and the author, whilst on leaving Para the number was increased by two Brazilians (a pilot and fireman) to assist in navigating the small steam launch, 25 feet in length, brought out from England. At Para we obtained introductions to the officials of the few towns on the lower Tocantins, and these were of great assistance in obtaining quarters, food, wood, and a certain amount of information. We found it almost impossible to acquire reliable knowledge of the rapids which were known to exist; indeed, there was such ignorance that many people said these were falls which no boats could pass. A man was discovered, however, who had come over these rapids in the big canoes or batalaos which bring the Brazil nuts (castanha) down to the port of Alcobaca, and from him we learned that these boats draw from 3 to 6 feet of water when fully loaded, and that our launch, which only required 2 feet of water, would therefore pass easily.

We left Para on 9 May 1922, and, after encountering very rough



Basin of the Tocantins River.

seas in the Marajo bay, which is really the mouth of the Tocantins, entered the Moju river, where strong currents were met. Passing through the Igaripy Miry and the Miritiocu channel, we gained the main Tocantins river where it is about 10 miles wide, and proceeded close up the east bank to avoid the current. Great circumspection was necessary in bathing here, as besides many water-snakes there was a poisonous palm growing in the water along the banks which, if touched, caused painful sores. We had a steam cooker fixed on board and heated by a small pipe from the boiler, and in this we cooked the meat or fish, rice, and beans, which are practically the only food of the district. We slept in hammocks or camp beds, the former hung from the iron stanchions supporting the awnings and curtains of the launch.

On the first evening in the Tocantins we encountered a storm, and, as there seemed danger of being swamped, we ran under the lee of an island. Starting again under a bright moon, we ran aground on a sandbank somewhere near the middle of the river, and all had to jump overboard to lighten and push her off. After some time she was floated and the voyage continued up the east bank of the river amidst eddies and whirlpools until Macajuba was reached, about 140 miles from Para. The houses are mostly of bamboo and mud walls with palm leaves for roofs, though a few more pretentious ones had tiles and were whitewashed. The inhabitants are the usual type of Brazilian, part African and part European, making their living by selling fruit (principally bananas), eggs, and wood to passing steamers which load up the Brazil nuts (castanha) from the batalaos at Alcobaça, and carry them down to Para. The town stands on a slight rise some 50 feet above the river, and is lighted by paraffin lamps.

One of the features of the country is the amount of black coffee which is drunk. Wherever one stops a small cup of this coffee is invariably offered, and no payment is ever accepted however poor the donor may be. We found it very strange and even injurious to drink black coffee the first thing in the morning without anything to eat until 10 or 11 a.m., when breakfast (alumerzo) was taken. The natives in this district wear very few clothes, and the young children go stark naked, not only the Indians, but frequently the poorer Brazilians.

Leaving Macajuba we passed two small towns, Baiao and Patos, and a week after leaving Para the lights of Alcobaça were seen ahead in the evening of May 15. Just before reaching this town the launch was nearly capsized by the overhanging branches of a tree, invisible in the darkness; one of the stanchions was badly bent and the writer knocked almost senseless into the well of the launch. We decided after this not to steam at night unless it was absolutely necessary. Alcobaça is about 230 miles from Para, and is quite a large town, whence at one time it was intended to build a railway to St. João de Araguaya, about 200 miles upstream. A French company obtained the concession as

long ago as 1895, and worked on the construction intermittently till 1906, when, through lack of funds, work was suspended until 1918. A fresh start was then made, only to cease again in 1919, all funds being exhausted, and the Para Government took possession against the moneys they had advanced. About 82 kilometres (50 miles) of railway had been constructed, but the route chosen was bad, passing over low-lying country which became flooded during the rainy season, so that the permanent way was destroyed. The whole line is now derelict, locomotives and rolling stock going to ruin on the track, with the fine engine sheds and machine shops at Alcobaça completely deserted.

From this point the banks of the river were low and the waters had encroached into the forest itself, the wet season not being finished and the river still high, so that of the smaller trees only the top branches were visible. In the distance hills could be seen to the west, the first sign of high ground since leaving Para. Steaming up the west bank from Alcobaça past low-lying forest, we reached Arumatheua in the afternoon, and here found Captain O'Brien, who had gone ahead on the river steamer with our luggage to make arrangements and obtain information about our passage through the rapids. It was a great relief to hear that motor launches were successfully passing up the rapids, a fact of which the people in Para appeared to be completely ignorant, and that our heavy luggage and stores had been sent on ahead by one of these boats to Maraba, some distance above the Itaboca rapid (Cachoeira), considered the worst of any we should have to encounter.

During the rainy season, when the river is high, the steamers from Para come up to Alcobaça to load up with the Brazil nuts which are brought down through the rapids in the native batalaos. These can pass the rapids only during the rainy season, which lasts from November until May; during the rest of the year only shallow canoes can get either up or down. We left Arumatheua on the afternoon of May 18, with a crew of six—three Europeans and three Brazilians—so that with most of our luggage on board there was little space to move, and the launch was 3 inches below the Plimsoll line.

We had just entered the first rapid, the water roaring past our bows with such force that practically no headway was being made, when suddenly the engine stopped. The pilot cried out, "We are lost," making the sign of the cross, and before it was possible for me to get the engine started again the launch was swept broadside on to the tops of some trees standing up above the water. All *did* seem to be lost, as the force of the current tilted her right over until the bilge pipe was only an inch above the river-level, and it seemed every minute that she must be flooded. The men worked like giants, standing on the trees in the water trying to free the launch on to an even keel; but all to no purpose. To everyone's relief, after some hours' suspense voices and singing were heard, and a big batalao slowly appeared up one side of the channel and gradually

worked its way up the rapid to an island a hundred yards or so ahead of us. To this its crew attached a strong rope, and then proceeded to slack off, allowing the batalao to drop downstream alongside our launch, so that all our heavy luggage could be taken off and the vessel lightened. After an anxious time, when it seemed as though the efforts to get her off would in themselves capsize her, she was clear, and then the difficult job of hauling her upstream by the winch we had on board was achieved.

The batalao which came to our rescue was typical of the craft used on this river. She was 50 or 60 feet long, and about 20 feet broad, flat bottomed, something like our river barges, but with a deck cabin made of bamboo and palm leaves at the stern, on the top of which is a seat for the steersman, the tiller working above the cabin. These batalaos have crews of from fifteen to twenty men, and are propelled upstream by long poles, some with hooks to catch the branches of trees and rocks by which the boat is hauled steadily upstream at 1 or 2 miles an hour.

Next morning, leaving our heavy luggage on board the batalao with Quaife to look after it, we continued our voyage, having several narrow escapes from running on submerged trees; but by judicious handling of the launch by our pilot, all the rapids encountered that day were successfully passed Our route was much the same as that of Henri Coudreau, so well described in his book 'Voyage au Tocantins-Araguaya,' 1896–1897. About halfway between Aramatheua and Arenao is the village of Arapari, 2 miles from the river; and 5 miles further inland passes the railway from Alcobaça, now abandoned.

Just above this village is a stream in which gold has been found. Near here we saw the first "boto" (freshwater porpoise). The village of Arenao is at the lower end of the celebrated Itaboca rapid, and here we stopped for the night. In the morning we were told that it was possible for the launch to pass the first small rapid fully loaded, and this rapid (called Arrependido) was successfully negotiated, much to the interest of the little colony of Brazilians who live here. We were now at the port below the great rapids where the batalao reload with the Brazil nuts which have been brought overland by donkeys from above the rapids, as it is only when the river is high that loaded batalaos can pass down in safety. Here all our luggage and stores were taken out of the launch, and here it was necessary to raise the sides so that the water should not swamp her as she was forced up against the current, and to engage men to haul the launch to help her engine. We Europeans went overland to the village of Itaboca Grande, 2 miles by forest track from Arrependido. Here we were entertained by a Syrian called Salim Jorge Moussalem. It took a week from our arrival at Arrependido to pass the Great Itaboca rapid, though the distance was not more than 2 miles, and twenty men helped to pull the launch through.

We had a splendid opportunity here of seeing how the heavy batalaos are brought up the rapids. Expert swimmers are engaged, and after

the vessel has been brought as close to the rapid as possible, the best swimmer fastens a light line round his shoulders, dives into the torrent swimming under water as much as possible, catching hold of a piece of rock here and a bush there, with a rest now and then to recover, until the desired position is reached from which the batalao can be hauled up the rapid into safety. Then ten or twelve of the crew follow him. A heavy cable 2 or 3 inches in diameter and possibly 200 or 300 yards long, is hauled up by the light line taken by the first swimmer, and turned once or twice round a tree or smooth rock, and, when the batalao has been manœuvred into a suitable position, the work of hauling begins. As she is slowly pulled up, the slack is taken up round the tree. Sometimes it takes hours to get past a rapid not 100 yards in length, and when the boat *is* up, the men are all absolutely exhausted. Most of the accidents take place when they are coming downstream, and try to shoot the rapids instead of warping themselves down slowly by rope. One cannot get a clear run either up or down, the channels being obstructed by rocks, but it would be neither difficult nor expensive work to clear these rocks away.

At present most of the trade is in Brazil nuts down to Para, from which port thousands of tons are shipped to the U.S.A. and Europe. During the rubber boom a large quantity of native rubber also came from that district, but in 1922 the price was too low. Oranges, lemons, and bananas, mamãos and pineapples, grow in great quantities. Coffee, rice, tobacco, and the mantioca shrub are also grown and do well here. Except when the river is at its highest, most of the batalaos coming downstream unload above the Itaboca rapid and have their cargo taken overland by donkeys, the storekeeper, Selim Jorge, making a little fortune over this porterage business.

It was a great relief when we had our launch safely past this part of the river, and in high spirits we set out from a stream called Bacury just above the rapid on May 30. At a rapid called the Pedra do Gaviao (Rock of the Hawk) it was necessary to use a rope, and though we had now engaged two extra men and also had two passengers, making ten all told, we only just managed to pull the launch through with all of us except the fireman and pilot in the water stripped naked and pulling for all we were worth. The Travessao de Pedra Grande, Aspenage, Furo de Pirocaba ("furo"=break through or backwater), Travessao do Saltinho, were successfully negotiated, leaving the Ilha do Jacob on the left and Ilha do Bacury on the right, after which the water was smoother and current less strong. The Ponta do Jacob, at the end of the forest track between Arenão below the rapids and Barboza, is a settlement called after a storekeeper now dead.

We were now above the upper entrance to the celebrated Itaboca rapid, and could see the mouth of the Canal Inferno through which nothing can pass on account of the current and rocks. There are three main channels

altogether: the Itaboca channel on the left, up which we passed (this is impassable in the dry season), the Inferno channel in the centre, and the Capitaricuana channel on the right or east bank. This last is sometimes used in the dry season by canoes, when the Itaboca channel is impassable. Motor launches, about 50 or 60 feet in length with 40 or 50 h.p. engines, do pass up the Itaboca channel comparatively easily, but until certain rocks are removed, descending the rapids will always be accompanied by some danger.

Leaving the Ponta do Jacoba, we passed the Tauiry Grande rapids, then the island of Cajuero, through the Cotovelo rapid and along Cotovelo island, past the island of Urubu (named after a kind of vulture), along the Cajuero channel, where a small range of hills to the east came into view one morning early.

Whilst sleeping on the Ilha do Alexandre one of our men was badly bitten by a bat, and we had great difficulty in stopping the flow of blood. This vampire type of bat seems to be very common in this district, both human beings and animals being attacked. Another danger is a kind of flat fish called Arara, something like a plaice in appearance, only having a tail some 6 inches in length, and halfway along this tail is a spike which it can raise perpendicularly when it senses danger, so that in bathing or walking in the water one is liable to step upon it. The spike contains a kind of poison, and any one suffering from a wound of this description very often dies. Luckily these fish only live in still waters.

After leaving the Ilha do Alexandre a number of smaller rapids were successfully negotiated, including the Bocca do Tauiry, though here the launch was nearly wrecked, the current at one passage being so strong that she was almost swept broadside on to a rock at our first attempt to pass. At the village above this point we first heard about a tribe of white Indians with blue eyes and fair hair, said to live on a tributary running into the upper waters of the Xingu. At the Ponta do Macaco (monkey) a little higher up, a small fleet of batalaos were moored to the bank, and in this part of the river more waterfowl were encountered, mainly geese, duck, cranes, kingfishers, water-hens, shanks, with several swarms of butterflies. The rocks around are mostly igneous, though occasionally sedimentary.

After passing the mouth of the Itacayuna river on the west bank of the Tocantins, we reached the town of Maraba late on the evening of June 4, four weeks after leaving Para.

We were most hospitably received, and given an empty house on the main street in which to live, and here we found all our stores and tools stored which had been sent up by motor launch from Arumatheua. Maraba is a fair-sized town of about one thousand inhabitants, having now a trade chiefly of Brazil nuts and a few hides, but it used to be the centre of a thriving rubber industry before the price dropped. Batalaos and hulls for motor launches are made here very cheaply. There is a

small motor launch running up to Imperatriz on the Upper Tocantins. This launch takes the post, and from here the mails go to São Luiz, the capital of the State of Maranhão on the Atlantic Ocean. There is also a small stern-wheeler launch which runs down as far as the Itaboca in the wet season, and up to Imperatriz, but it burns a great deal of wood and is slow. One of the letters we had brought from Para was addressed to the Intendente of the municipality of Maraba, so we were shown every attention and civility. The town is 225 feet above sea-level, and about 450 miles by river from Para, which could be reached in a little over a week by a good motor launch, if one was running. There is great regret that the railway from Alcobaça was not completed, the people here thinking that it would pay handsomely, as it would pass right through the centre of the rubber and castanha district, whilst very valuable forest timber and highly mineralized country would also be traversed. Both cattle and sheep are raised in this district, the former doing better, though the quality is not up to European standard, it being rare to find a beast weighing more than 5 cwt.

We left Maraba on June 8, steaming slowly as the current was very strong and the river shallow. At this point during the height of the dry season it is possible to ford the river, and tracks could be seen where the cattle from the north of Goyaz are brought down to Maraba, whence the hides are sent to Para.

The Secco Taurinsinho, the rocks of which are mostly sedimentary, was passed safely, though a strong current was met, and the Ilha das Fleicheiras (arrows) reached, the launch running along the north bank of the river, which had taken a turn to the east at Maraba, past the Ilha de Mai Maria and the Secco of the same name, until the Secco do Bacabal was reached. Here the country is a good deal flatter, with mud banks and forest stretching right down to the water's edge, overgrown with creepers like the country near Para. The following day São João dos duas Bairas hove in sight, about 50 miles above Maraba: a small village on a high bank of schist about 100 feet above water-level, where the Araguaya joins the Tocantins. It was a military outpost in old days, and there is still a brass cannon on the cliff overlooking the river. The houses are mostly well built of stone, with wooden floors—a most unusual luxury, very different from the mud walls and floors generally encountered in these parts. There is a chapel dedicated to São João on the edge of the cliff overlooking the river, underneath which we were gravely assured lives a sacred snake, the guardian of the town, which never eats anything and which no one but a sainted priest of olden days has ever seen. We were most hospitably entertained by the chief men of the village. The women seemed more independent, willing and even anxious to converse, and very different from those we had seen at previous places. We learned that two Canadian engineers had been up as far as this ten or twelve years ago.

Just as we entered the mouth of the Araguaya river some very strong rapids were encountered, but once these were passed the current was much less and good progress was made. At an island above São João, O'Brien almost had his thumb bitten off by a fish called Piranha, just as he was splashing water over his face. These fish are comparatively small, about the size of a roach, weighing possibly 2 lbs., but are so voracious that they will attack human beings and animals in the water, and are sometimes met in such numbers that the victim almost bleeds to death before land is reached. They are very good to eat, and, once the art of catching them is known, can be obtained in large quantities, fresh meat being the most attractive bait to use. The wounds which they inflict do not seem to be poisonous, for, after being washed with disinfectant and carefully bandaged, Captain O'Brien's wound did not fester, and caused him very little inconvenience, though it took some weeks to heal.

At Bacurysinho is a small house on the Para side, on a cliff of sandstone overlooking the river. At Bacury Grande de Araguaya, also called Ponto Avel de Nazareth, the rocks are mainly sandstones with signs of mineralization. The river-bed and banks were now mostly of sand, with occasionally a small rapid. Above Serubin a rather difficult rapid called Travessao Carmo (2 miles in length) was successfully passed. At the Travessao São Bento, a little higher up, there were a number of whirlpools and eddies, which give the place its name of "The place of troubled waters," the river here being over a mile wide. São Vincente is a village which dates back to 1877, on the Goyaz bank, 80 miles from São João, on rising ground some 50 feet above river-level. In all these places oranges and bananas are particularly abundant, and by eating oranges in quantity our health was improved and fever kept away.

Here is the "chapada" or "campos" country well described by James W. Wells in his book 'Three Thousand Miles through Brazil' (1886). This writer likens it to "a wild neglected English orchard, overgrown with underwood, bushes, and grasses, the trees small and extremely distorted and much scattered." The Goyaz plateau is largely chapada, as also is the southern part of Para State, the forest being found chiefly along the banks of the rivers, and except for the Montes Pyreneos, which run more or less through the centre of the state of Goyaz from north to south, there are practically no mountains in the state worthy of the name. Mr. Wells's description of the inhabitants in the wilder parts of the country holds good to-day; they are still nervous of strangers, but once satisfied that no harm is meant they are the most hospitable people in the world.

Fair numbers of cattle are raised in this district, which forms part of the tableland of Northern Goyaz, and here we first saw the peculiar leather suits worn by the cattlemen, almost like armour, to protect, themselves from the thorns when rounding up cattle in the bush. The

feet and trousers are all made in one, of deerskin, which appears uncomfortably hot for tropical wear. Their horses are small, probably with some Arab blood, and the mules also are little more than half the size of those in the Argentine. Many of the people suffer from a low kind of fever, and continually demanded medicines from us, as no medical men or apothecary ever seems to visit these regions, though medicines are brought from Para in canoes and sold by the one and only storekeeper, who is usually a Turk or Syrian. Quinine is obtainable but very dear, two or three tablets costing sixpence, so that only the wealthy can afford to buy it.

A range of low hills runs across the river just below Santa Isabella, with high bluffs on either side. Santa Isabella is a small settlement at the foot of the Cachoeira Grande, on the west or Para bank of the Araguaya, while the old São José settlement is some distance lower down on the Goyaz side, an old military post long since abandoned. About 30 miles to the south could be seen a range of hills marking the upper end of the Cachoeira Grande, where the new São José de Martyrios is situated. We had come some 50 miles from São Vincente, and were about 630 miles from Para by river, and 325 feet above sea-level. It was arranged that the pilot should take the launch up these rapids with what crew he wanted, whilst we explored the surrounding country, having heard that " pedras bonitas " (beautiful stones) were to be found in quantity. The only way to send letters from this point is overland to Boa Vista, on the Tocantins 100 miles away, by mule track, the journey taking about three days.

The next fortnight was spent in examining the surrounding district for precious stones and minerals, the country, especially in the uplands, being mainly sandstones and schists, though occasionally diorites and granites were encountered. There is gold in the district, but perhaps not in payable quantities. The country is rough; paths must be cut through the forests; the hills are precipitous; and insects are in quantity, especially *carapatas*. Captain O'Brien had one or two bad attacks of fever (a heritage from the Congo), and Mr. Quaife was inclined to have a touch of dysentery; otherwise the party was in excellent health, though I was troubled with boils on the legs, which made walking, and even riding, very painful. We were shown great hospitality and kindness by Snr. João Matheus, the most important man in the district, who provided us with animals, and himself guided us through the forests. The tracks of leopards and wild pigs were frequently seen, whilst a large amount of bird-life, of the partridge and buzzard type, was fairly prevalent.

The launch passed safely up all the rapids, taking about a week to travel the 35 miles from Santa Isabella to São José de Martyrios, 435 feet above sea-level. This locality is about as far north as it is possible to find the " castanha " or Brazil-nut tree in any quantity, and from here 30-ton batalaos are sent down to Alcobaça or even to Para, the round

trip costing about $3000, at that date about £90, or £3 per ton for food and wages of the crews and pilot. The people mostly live by collecting these nuts for sale and growing their own fruit, sugar, coffee, and cotton. Some cattle are also reared, and the skins sent down the river for sale. Our food was mainly dried meat, rice, and beans costing about 6*d*. per day per head. Good drinking-water can be obtained from any stream. The Brazilian up country makes no bread; in fact, flour is unknown, as he always uses Farina da mantioca, a coarse meal made from the roots of the mantioca shrub, which are dried, crushed, and roasted. This meal is either eaten dry with meat or sugar, or is mixed with the rice and beans, and boiled in pork fat.

On July 2 we left São José, passing the Cachoeira Arara Comprida with some difficulty owing to the shallowness of the river, and whilst examining the rocks on the river-bank we came across numerous tracks made by very large leopards. The Ilha do Campos was reached in the afternoon, and here both cattle and leopard tracks were seen. On some of the numerous sand islands egrets were seen in pairs. They did not seem at all disturbed at our approach, so they are evidently not hunted here. Just before entering the Secco do São Miguel we passed a big quartz reef running right across the river, above which was a series of small rapids formed by bars of limestone. Still passing through rocks, many of which were schist, the island of Coco was reached; and a little further on, when passing some more rapids the launch was nearly wrecked.

Shortly after this we came to more rocks, through a passage in which the water was simply raging in a mass of white foam, and it seemed impossible that we could get through. However, with a full gauge glass and steam blowing off we made a dash for it, and with two of the men poling in the bows with all their strength after a few perilous moments, when there was a desperate fight between the current and ourselves, we managed to scrape through. Just above this rapid, the last of the São Miguel series, we encountered Caraja Indians for the first time. These Indians are "manse," or friendly, and live principally on the upper part of the Araguaya. They were coming downstream in a big dug-out canoe, stark naked, with rings in their lips and noses, painted all over with a kind of crimson-lake colour. We found out afterwards that they smear themselves with this paint, which is made from a forest berry called Urucu, red in colour, which is pounded up to a paste, mixed with oil from the Babassu Palm coco nut, and then boiled over a fire. This mixture is said to keep off mosquitos, cerapates, and other forest insects. They were fine-looking men, well developed, with features rather like the North American Indian.

At Pedra Branca we found living the aunt of one of our crew named Raphael. When she heard that we had treated her nephew well she could not do enough for us, and cooked us a splendid dinner of chicken,

eggs, fish, bananas, etc., followed by home-grown coffee—the best dinner we had had since leaving Para. She told us that the Caraja Indians here were quite friendly and very good to her, bringing her fish and sweet potatoes when her man, a Brazilian, was away, and never molesting her in any way. Here we found igneous and metamorphic rocks, some highly mineralized. From Pedra Branca the river tended due south, and after stopping at the Caraja camp, a collection of huts made from palm leaves, we found (with the exception of one old man) no one here but women, who seemed delighted to see us after having overcome their first terror, and who gave us bananas, yams, and eggs, in return for which they received some Brazilian tobacco, much to their delight. These Indians tame and train diving birds, a kind of redshank, to catch fish for them. The women seem fairly clean; wear nothing but a little cotton slip between their legs; and some have quite good features. It was the men from this village whom we met in canoes just above Pedra Preta. They build these palm and bamboo huts on the sandbanks at the beginning of the dry season, but as soon as the rains start they abandon them and go inland, leaving the waters to sweep away completely their late dwelling-places.

Above this camp some igneous rocks were passed on the Goyaz side, but further along low-lying mud banks with the forest coming right down to the water's edge again prevailed, and at the next stopping-place the tracks of tapirs (antas), which inhabit this kind of country, were seen. Higher up the banks were mainly argillaceous schist. That day we reached another solitary house at a place called Itaipava, where the men who had just returned from a hunting trip were cutting up deer, tapir, and turtles which they had killed—their sole source of meat. We turned south again here, while to the west could be seen a range of hills called Cinzano, running parallel to the river a few miles inland. The Correinha and Anderinha rapids are formed by bars of diorite crossing the river. Near the latter flocks of flamingoes were seen standing by the water's edge.

At a Caraja camp a little further on, we found the chief or captain to be quite intelligent for an Indian; he could speak a few words of Portuguese, and had even heard of Belem (Para), but thought that it was at the end of the world, and would not believe that we had come from a country across a sea four or five times further away. A little later came the Brazilian village of Pau d'Arco (Wood of the Bow), and the following day the rapid of that name. The water was very low here, and it was necessary to obtain assistance to pass up this rapid, which was only accomplished at the second attempt, all on board having to strip and help to pull the launch through the waters, which were rushing and foaming over the rocky channel. Then came the Jacu, Pacu, and Joncão rapids, the last before Concessao, 40 miles up-river, is reached, and here the rocks were of granite. Our pilot's old mother, a real

SÃO LUIS RIVER ON BANANAL ISLAND

LAUNCH "BOA AVENTURE" AFTER PASSING ITABOCA RAPID

BATALAOS AT PONTO MACACO

BUSH FIRE ON RIVER ARAGUAYA

SÃO JOSÉ DO ARAGUAYA

negress, lived in a house just above this last rapid, and we were able to procure a big duck for dinner—a welcome change after the diet (or lack of it) we had been having. There is a small range of hills running east and west here, through which the river cuts. Concessao was reached on the morning of July 16 without further incident. The town is on the left bank of the river, which is about 2 miles wide, and the ground rises on sand and gravel banks to some 20 feet above water-level. It was founded by some French priests twenty-five years ago, and there are still a number of Dominicans who have their headquarters and are, in fact, building a big monastery and church from the excellent building material to be found in the vicinity.

During the rubber boom the town increased very rapidly, and it is said that over 10,000 people were then living there, which number has now been reduced to not more than 4000. There are still large areas between the Araguaya and Xingu where rubber trees grow in quantity, and as the price increases and the river becomes better known, the town may again become important. At the time of our visit rubber was only fetching about 1½*d*. per lb. locally, and it was not worth while trying to collect it. The municipality is large, stretching from São José de Martyrios at the Cachoeira Grande 6° 15′ S. to the boundary of the states of Para and Matto Grosso, by some stated to be at 10° 15′ S. (the north end of Bananal island), but by the secretary to the municipality, Snr. Salustrians de Moraes, to be at 11° 15′ S. where the Itapirape runs into the Araguaya. The area of the municipality is some 50,000 square miles, and the population about 22,000..

In Brazil each state obtains its revenue chiefly by taxes on products exported from the different municipalities (of which there are fifty-six in the State of Para), whereas the Federal Government collects the greater part of its revenue from customs, postal, and telegraph dues throughout the whole of Brazil. The states are divided into municipalities which may be likened to our counties, and at the head of each is an "intendente," who, with the municipal council and its secretary, is responsible for the administration of the municipality, including the collection of all taxes, etc. Both intendente and council are supposed to be elected by popular vote.

By kind permission of the Intendente of the town, to whom we had a letter of introduction, Snr. Salustriano accompanied us on a trip into the interior towards the Xingu, which lasted about a fortnight, and we were able to gain valuable information on the topography and geology. A great deal of the country was "campo," or open tablelands, sometimes covered by iron conglomerate, with small scrub and good pasture. Ranges of hills were chiefly schists or sandstones, with occasional granite and even basalt intrusions. In some of the streams gold was discovered by panning, and the country appeared to be promising from a gold-mining standpoint, whilst from information and specimens

obtained both lead and copper minerals would seem to exist in the vicinity.

The Serra de Roncador, which forms the dividing range between the Araguaya and Xingu rivers, is most certainly metalliferous and well worthy of further investigation for gold, diamonds, copper, lead, and silver. The only industries at present are cattle-raising, sugar, rice and tobacco plantations (rocas), and, with the prices then prevailing, little more was produced than what was required in the immediate district. The land is very fertile, well watered, and nearly all " devolute " or unclaimed Government land, on which the people settle, raise their stock or grow their sugar, etc., without payment of rent. At one locality in this district basalt, with inclusions of iron pyrites crystals, was discovered.

After completing the trip to the west as far as Salobro, a place about 112 miles from Concessão on the edge of an almost impassable forest (the first we had met in this district), we returned to Concessão, which was reached on August 7, when O'Brien and the writer, who had made the trip, found that Quaife had left for the coast, taking the opportunity of returning overland with a trader who was making the trip. He had been unwell for some time, and it was thought best by all that, under the circumstances, he should return at the first opportunity, since after leaving Concessão we should be getting into Indian country and would have to rely upon our guns for meat if not for our own safety, and a sick man is useless under such conditions. After a few days' rest, Captain O'Brien started upon a trip overland to one of the rivers crossed on the previous journey, called Arrayas, which he intended to explore up towards Santa Maria Nova, and make his way overland to that village, which is on the Araguaya about 65 miles above Concessão. The Arrayas river rises in the Serra do Roncador, and is the longest of the four which we crossed on the trip to Salobro, and flows into the Pau d'Arco river just before the latter reaches the Araguaya, a little below the Pau d'Arco rapid. Whilst Captain O'Brien travelled up the Arrayas, the writer crossed the Araguaya to a place almost opposite Concessão, called Couto Magalhaes or Porto Franco, on the Goyaz bank, at the invitation of the Intendente and Colonel Zequinha, a political notability of the district, to make an exploratory trip on the Goyaz side. As at Concessão, the officials kindly supplied the animals and a guide, helping in every way and expressing an extreme desire to assist any scheme which might develop the country and bring more business to the town. From Porto Franco a track running to the south-east was taken, the country being mainly open pasture land, well watered by small streams. The rocks were chiefly sandstones and quartzites, with occasional diorite and gneiss. At one place a splendid deposit of limestone was seen heavily mineralized with good-sized cubes of iron pyrites. This limestone is being used by the priests for the manufacture of mortar for their building operations. Gold was found by

panning in numerous streams, but though it was said that diamonds were also present in at least one river crossed, the panning tests gave no such result. Iron and manganese exist in fair quantities. A range of hills called Morro Grande was reached about 100 miles from Porto Franco, going towards the Tocantins river, and after this had been examined the return journey was made and Porto Franco reached after a trip lasting altogether about ten days. Part of the country explored was inhabited by a tribe of Indians called the Xerentes, who are sometimes not very friendly, but none were encountered though we had come across one of their old camps near Morro Grande.

Crossing from Porto Franco to Concessão in a canoe, which took three-quarters of an hour, we put all our tools and stores on the launch ready for a fresh start, and after saying good-bye to all the numerous friends made since our arrival, we left Concessão on the morning of August 26, our stay in the district having lasted six weeks.

After passing the Santa Maria Velha (old) travessão, which the launch did fairly easily, the Calderao rapid was rather difficult. With six extra men to assist the launch passed safely, but the cargo had to be taken out and carried over the bar. The Tres Portes (Three Gates) rapid was reached and passed in two stages, the first part being the worst. At this time of the year (August–September) the river is at its lowest, and great difficulty was experienced in finding channels between the sand-banks with sufficient water for the launch to pass.

Above the mouth of the Piranha the banks became higher, and there were indications of limestone, though a small rapid passed later was caused by a bar undoubtedly metamorphic. On the morning of August 29 the rapid of Ste Maria Nova was reached, and, after attempting the western channel unsuccessfully, the centre channel was tried and the launch negotiated under her own steam though a rope had been put out ready for hauling. Just past this rapid the village of Ste Maria is situated on the Goyaz bank, and here Captain O'Brien was found, having completed his journey up the Arrayas, which proved of little interest but of some hardship, two or three days previously. This village is built on a bank about 50 feet above the river opposite the Ste Maria Nova rapid, and commands a magnificent panorama of the river, hills, and forests on the Para bank. Steaming slowly on account of the shallowness of the river, we passed the Cayapo rapid fairly easily, and then several more smaller ones without any trouble. Several more small rapids were encountered before that of the Ste Anna was reached, which is the last one for several hundreds of miles up-river. This turned out to be rather swift, and at this time very shallow, though we had taken the deepest channel up the east bank. The launch was manœuvred into position for a dash, and then went full steam ahead, passing the worst part, but just as she seemed to be safely through she struck a rock, the current caught her bows, and she was swept broadside on to another rock.

It was an anxious time, and all were afraid that the launch would be lost, but by almost superhuman efforts we managed to lever her into a more secure position, though she was still stranded in the middle of a raging torrent on the top of some rocks. The anchor was put out in front, and a canoe luckily coming up with a Brazilian and his wife on board, we were able to procure some long poles from the forest with which the launch was gradually levered off the rocks on which she was stranded, into deeper water.

We continued up the Goyaz channel until just past the Ste Anna on the Para side, and dropped down to the landing-place just above the rapids on the west bank. The village is small, of some twenty or thirty houses, and is about 80 miles above Concessão, to which municipality it belongs. An empty house was given to us in which to stay, and the chief inhabitants came to pay their respects and to ask us to explore the vicinity for minerals. One man was extremely anxious that a locality some 50 miles away should be visited, in which there appeared to be a copper ore deposit, according to his description, and he arranged to provide animals for the trip. It was decided to go, and the following day we steamed about 4 miles up the west branch of the Araguaya to the mouth of the river Anaja, called by the Indians Cuxuru, and said by some authorities to be the old boundary of the states of Matto Grosso and Para. Indeed, in some maps it is still represented as being so, and is also shown, erroneously, as joining the Araguaya opposite the north end of Bananal island, and sometimes even called the Itaparapé.

The country was chiefly "campo," with low trees and fairly high grass in which deer were sometimes seen. There seemed to be some doubt as to exactly where this deposit of copper ore lay, and as, from information obtained the previous day, it seemed as though after all it might be only iron pyrites, we decided to give up the trip, time being short, and to return to the launch at Ste Anna. Here provisions were obtained for a month, as we did not anticipate coming across any one but Indians for the next four weeks at least. A little shooting was obtained here, there being plenty of pigeons, doves, parrots, jacu (a kind of pheasant), mutum (buzzard), jackdaws, urubus, ducks, geese, partridges, and wild turkeys, also deer, tapir, water-hogs (capivara), leopards, wild pigs, and otters. A curious kind of water-turtle was also seen, with a broad flat head more like a serpent's. We left Ste Anna on Saturday, September 9, early in the morning, and were soon in difficulties on account of the shallowness of the river at this time of year, having to pick our way through sandbanks. Men waded ahead of the launch, and it looked very strange to see two men in the middle of a river a mile or so wide, wading about up to their knees. In spite of the alligators and piranhas in the river we had no mishaps, and we concluded that they must have been frightened by the noise and disturbance caused by the launch propellor. We

experienced now, for the first time on this trip, the effect of the insect commonly called the "jigger."

About 35 miles from Ste Anna, on the east side of the river, is the river Coco, its mouth so silted up with sand that it was not possible to explore it. Further on, the Barreira do Campo, where a few Brazilians live, was passed on the Para bank, and higher up a Caraja camp on a sandbank. The Carajas here had their long black hair done up in a kind of pigtail, something like the style of the English sailors in Nelson's time, plaited with grass. A Caraja agreed to pilot us up to Bananal island, some 60 miles further south, and next morning he arrived, his sole adornment an elaborately plaited pigtail and an old Winchester rifle. During the day several small canoes were passed with Brazilians on board with their women folk, going up to the Rio das Garcas (River of the Herons) to try their luck at diamond washing. There are said to be from 12,000 to 15,000 people on this river, many actually engaged in washing the gravel with large bateas made of wood, and the remainder trading, hunting, etc. This river is some distance above Registro, the old customs town, on the bank of the Araguaya, where the ancient mule-track crosses from Goyaz to Matto Grosso. Our course was very zig-zag, following the main channel which wound through sandbanks from one side of the river to the other, almost doubling the distance we had to travel. The banks here on the Para side seemed to be formed of a kind of yellowish clay or marl, and stood from 15 to 20 feet above river-level. The first turtle track seen on the trip was noticed to-day, looking like the marks of the caterpillar of an army tank on the smooth sand. At Barreira das Pedras or dos Veados (deer) was a deserted house, near which we stopped for the night, and here several geese were shot, which formed a welcome change from the dried meat which had been our principal food lately. On Wednesday morning, September 13, we reached the north end of Bananal island, after passing a fairly large island called variously Ilha de Ste Maria, Ilha de Ste Anna, and Ilha do Barreira das Pedras. Bananal island, some 200 miles by river above Concessão do Araguaya, is one of the biggest, if not the biggest, fresh-water island in the world, being 200 to 250 miles in length and over 100 miles wide, according to local authority. It has never been surveyed, so these distances are only approximate. We took the west branch, which is the larger and contains more water, the bank on the Para side being some 15 feet in height, of clay, and on top of this bank the first deer was seen. On a sandbank close to a Caraja camp a large bird called "Jaboru," was seen, something like a stork in appearance and habits—white with a black head, and usually found standing on a sandbank just in the water, apparently looking for fish. It makes its nest in the fork of a tall tree by the river's bank, and flies with a long and slow wing motion, with its legs straight out behind. This branch of the river is still over a mile wide in places, dotted with low sandy islands which are mostly completely inundated

during the rainy season. The Carajas were most useful in supplying information on the channels, but in spite of this we had several times to return from channels they had indicated and try others, though we always managed at last to get the launch through. Caraja camps were more frequent now, sometimes two or three in one day, and they were invariably on sandbanks or islands. Canoes from their camps generally put out to meet us, mostly with only men on board, but sometimes their women came also. There was plenty of bird-life, and we were always able to shoot a duck or goose, while fish also were plentiful. Sometimes it was possible to get a few eggs, bananas, and sweet potatoes from the Indians, but this was not generally the case.

We were now approaching a small Brazilian settlement on the Para bank, called Furo do Pedra on account of the river here running over a bed of soft rocks and cemented gravel. This is the only settlement at present in the vicinity of the Bananal island inhabited by others than Indians, though there is now a scheme on foot for the establishment of an English mission a little higher up on Bananal island itself. It was necessary to steam very slowly and carefully here, as the river was very shallow and the launch was continually scraping the bottom, or possibly boulders of this cemented gravel. At the settlement there was a party of Brazilians in a fleet of small batalaos, waiting for us to come, having heard of our approach, as they wanted our company through the Chavantes territory which lies a little higher up. All the people were going to try their luck at the diamond field of the Rio das Garcas, about 500 miles above this place. The next few days were spent in the company of the batalaos. Several Caraja camps were passed, and the inhabitants were always friendly, selling what few things they had for a little tobacco or rapadora. These Indians smoke a short straight pipe of wood, shaped very much like a large cigar-holder. Just before reaching the mouth of the Itapirapé river, which lies about 120 miles by river above the north end of Bananal island, some Indians were seen on the island whose behaviour was rather peculiar, as though they would have liked to attack us had our party not been so strong.

Below the Itapirapé the Araguaya runs in a comparatively narrow channel not more than 300 yards wide, with a high bluff on either side. Up the Itapirapé river a tribe of Indians called Itapirapes have their villages, but little is known of them, as the territory has not been explored. Some say that they were originally part of the Caraja tribe, and that after an inter-tribal quarrel they left the Araguaya and settled up the Itapirape. Others again say that they belong to the Canoeiros, who live on the mainland in Goyaz opposite Bananal island. The Itapirape Indians, though not so hostile as the Chavantes, are supposed not to welcome strangers into their territory, and in this respect are more like the Canoeiros than the Carajas. Towards the source of this river there is said to be a large salt deposit, where all the Indians who inhabit the

country between the Araguaya and Xingu congregate once a year, and many say that it is here that the white Indians, called "Assurini," are to be met. At Concessão we heard from a prominent trader there called Jose Rodrigues Franco, that these Indians had camps at three places on or near the Xingu, called Lua Nova, Ilha Grande, and Baba Guaza.

It had been our intention to explore the Itapirape (said by some to be the boundary between the states of Para and Matto Grosso) as far as possible, but the water was so shallow at its mouth that it seemed hopeless to attempt it at this time of the year. The next few days passed without incident, though they were fairly strenuous, the whole party having to be constantly overboard wading to find the right channel. There was plenty of game about, deer, geese, and duck all forming welcome additions to our larder. Some of the deer are quite large and have splendid antlers, but the smaller ones which inhabit the forests are the more tender.

A good look-out was now kept on the west side for signs of Chavantes, the hostile Indians of whom the Brazilians and Carajas are very much afraid. Plenty of shooting could be obtained, and we usually replenished our larder whilst wood was being cut at midday. At one place some capivaras (water-hogs) were found at a lagoon a little way in from the river, and two were shot. One animal fell into the water, which was too shallow to cover it. Before we could get round to it the piranha fish had commenced to eat it, jumping right out of the water on to the animal's back. At about 70 miles above the Itapirape by water we came to a big Caraja camp called Boa Esperonza, where the Indians gave us great assistance in getting through the shallow stretch of water just below their camp. The following day, Sunday, September 24, we arrived at another big Caraja camp called Santa Isabella, just below a low range of hills, which crossed from the Matto Grosso mainland to Bananal island. These Carajas had home-made earthenware water-pots and plates to sell, the first time we had come across anything made by these natives. Camping just above this point, we saw some deer coming down to the water for drink, and shot one, much to the men's delight. The Carajas themselves rarely manage to procure a deer, as they have usually nothing but their bows and arrows, and are not especially expert in the use of these, being entirely river Indians and more accustomed to fishing than hunting.

On the following day we passed the mouth of the Rio dos Mortes early in the morning, about 240 miles by river above the north end of Bananal island. We had intended exploring this river in spite of the Chavantes through whose country it passes, but the water was too shallow; indeed, we had great difficulty in passing up the Araguaya here, for, besides sandbanks, the river was strewn with the trunks of trees left stranded as the waters subsided. There was only a narrow passage close to the bank of Bananal island, and along this the river was rushing

with great force, so that we had difficulty even in fighting the current. We had to land on the Matto Grosso side in the Chavantes country to get wood, but saw no sign of these Indians. They used to live in the state of Goyaz, with the Xerentes, another tribe speaking the same language who now live in the north of Goyza ; but not having sufficient liberty and disliking the Brazilians, they crossed the Araguaya and now occupy chiefly the territory between the Rio dos Mortes and Rio Crystallino. Caraja Indians were still met on the Bananal side, but they will not land on the west bank if they can help it, being very much afraid of their hostile neighbours. Besides the Carajas there is another tribe called Javahis, who live in the interior of the Bananal island, and are little known, but said to be friendly. Doctor Fritz Krause, in his book 'In den Wildnissen Brasiliens,' describes in detail the customs of the Caraja, Itapirape, Javahi Indians, he having visited their villages in 1908, travelling by canoe from Leopoldina to Concessão. These tribes appear to be just as uncivilized now as then, though, owing to the greater number of Brazilians voyaging up to the diamond fields, the first named are more accustomed to strangers.

Above the Rio dos Mortes the Araguaya is considerably narrower, with fewer islands, and clay banks 10 or even 20 feet above water-level. The river seems also to have changed its course considerably, as old beds could be seen. The Rio dos Mortes obtains its name from a massacre which took place many years ago during the slave days. A Portuguese explorer and his son are said to have found good gold up the river, and to have returned to the coast to form a big exploration company to work the deposit. Having done this, they set off for the place, but were followed by a party of Brazilians, and when they met on this river a fight took place, in which both parties suffered severely. Before they could get away, the Indians attacked and annihilated the survivors. Hence the name "The River of the Dead."

On Sunday, October 1, we passed the mouth of a river coming into the Araguaya from Bananal island. It had been discovered only the previous year by a Brazilian, and takes its name, Rio São Luiz, from him ; it is the only river so far found in the island. A little later, just below the mouth of the Crystallino river, 110 miles above the Rio dos Mortes, we met a big batalao coming down empty from the diamond fields of the Rio das Garcas, where the owner had been selling foodstuff and merchandise. The owner warned us about the Chavantes, and told us on no account to land on the western bank, as only recently a Brazilian and his wife travelling in a canoe up the Garca had landed to get honey, been surprised by these Indians and murdered. A little distance above the Crystalline river turtles were unusually plentiful, and in one day we were able to find over four hundred eggs from four holes only.

The south end of Bananal island was reached on October 3, the voyage along the island alone having taken twenty days, and we must have

steamed 400 miles, following the course of the river, though the island itself cannot be much more than 200 miles long. The east branch which we had intended to go up was closed by sand, and navigable only in the wet season—probably from December to May. Above the island there were no large sandbanks on which to camp, and the mosquitoes were a great deal more troublesome in consequence. We overtook a small canoe with Brazilians on board, and on inquiry found that they had left the Furo do Pedra on September 6, two days before we left Santa Anna, so that we had steamed quite 500 miles whilst they had covered not more than 300 miles in about a month. These people also were going up to the diamond washings. Caraja Indians were still encountered, but not so frequently, and about 40 miles south of Bananal a lagoon was passed on the Goyaz bank near which a number of cattle were grazing; there was a large fazenda in the vicinity. On October 5 we passed the mouth of the Crixas river, about 50 miles above Bananal, also silted up with sand, making entrance by launch impossible except in the rainy season. The following day the first really heavy rain of the season was experienced. At one camp in this district a large bird, quite new to us, was encountered, like a vulture, having five talons on each foot, and one talon or spike on the middle joint of the wings, which measure nearly 6 feet from tip to tip; the bird is black except for the breast and underside of the wing. Locally it is called Iuma, and it makes a noise very much like a dog barking. It is generally found near a lake, and when frightened it takes refuge in a tree.

On October 7 we reached São José de Araguaya, our destination on the river. Here we intended to disembark and make our way overland to a gold-mine at the village of Crixas, some 200 miles away by mule-track. Including the explorations inland, the journey had taken five months, during which time we had no communication with the outside world. We had travelled between 1500 and 1600 miles by river from Para, through territory almost unknown, and were the first (so far as we could learn) to steam successfully up the river from Para.

Brazilians however had travelled part, if not all, of the way up this river in motor launches recently, and the Goyaz Government about thirty years ago had brought large steam launches above the rapids in sections, rebuilt them on the river, and ran them between Leopoldina and the Cachoeira Grande for about six years, when Conto Magalhaes was President of the state of Goyaz.

The Araguaya and Tocantins are undoubtedly navigable at present by small shallow-draft steam or motor launches with powerful engines. Before large craft can be employed, a certain amount of work must be done in clearing away some of the rocks which stand in the fairway of the worst rapids, but this would be neither an expensive nor a difficult undertaking. There is an enormously productive area waiting for development: rubber, brazil nuts, rice, sugar, tobacco, cotton, cattle,

hides, tropical palm nuts, etc., are grown easily all over the country traversed by these rivers, whilst the mineral resources are untouched, and we found gold, copper, lead, and nickel. The climate is good, the people willing and honest, and only European energy and enterprise are lacking to make this part of Brazil one of the most flourishing and populated parts of South America.

During the whole of the voyage wood had been cut from the banks of the river and used fresh the same day in the boiler without trouble. The timber was mostly hardwood, the best kinds being called locally Pau Vermelho, Pau Preto, Vergolino, Amersao, Goyabinha, and Capuerana. In the lower reaches of the Tocantins and Araguaya the forests are full of splendid trees suitable for all classes of work, construction, furniture, and boat building, and these trees are also found, though possibly in lesser quantities, all over the State of Goyaz. For buildings, factories, waggons, etc., Angico, Pau d'Arco, Aroeira, and Jatoba are excellent; for furniture, etc., Cedro, Pau Roxo, Peroba, and Jacaranda are in great demand; whilst for canoes, Genipopa and Landy are mainly used on account of their lightness.

The object of this paper being to attempt some description of the less known districts traversed by these rivers, I need not describe my subsequent explorations overland, nor the voyage made by Captain O'Brien up to the Rio Garca in the following spring, which voyage was unfortunately fatal, as he contracted an illness which necessitated his return to England, where he died only two weeks after his arrival. The greater number (about 120) of the photographs taken on this trip were so damaged by water that they were failures, and it is mainly due to the courtesy of the Minister of the Interior to the State of Goyaz and to Snr. Carlos Herndl, chief of an expedition in 1921 to the island of Bananal, that many of the photographs shown herewith are due. The books on part of the country by Dr. Paul Erenreich and Henri Coudreau were of great service, and though the population has increased and shifted, their maps of the river are substantially correct.

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: We are to have some account this evening of a part of the world of which we very seldom obtain any first-hand information, namely, the interior of Brazil. Indeed, such previous information as we possess with regard to the two main rivers of which the lecturer, Mr. Bullock, is going to speak is contained in reports, now a good many years old, one of which was written by an eminent geographer who was for nearly thirty years—actually from 1864 to 1892—the Secretary of this Society, Mr. H. W. Bates. The other report from which we have obtained some information and a tolerably good map of the upper part of one of the rivers of which we are going to hear, the Araguaya, was compiled by a Frenchman, Monsieur Coudreau, also, I think, during the closing years of the past century. You will see, therefore, that the country of which we are to hear is very little known, and it is true, I think, to say that the lecture this evening will prove to be the first published account of any general investigation of the possibilities of these rivers, the

Tocantins and the Araguaya, from the point of view of navigation. We are consequently much indebted to Mr. Bullock, who spent some considerable time recently in examining the possibilities of these rivers, for coming to give us an account of them this evening. I now ask Mr. Bullock if he will be kind enough to give us his paper.

Mr. Bullock then read the paper printed above.

The PRESIDENT: Mr. Bullock has indeed taken us through a little-known country; so little known is it, indeed, that I have not succeeded in finding any member of this Society who is capable, or at any rate who has expressed any desire to add to what the lecturer has said. It is true that I did discover, accidentally, just before the meeting that one genial member of our Council has had considerable experience of travel in Brazil. I asked him whereabouts in Brazil he had travelled, and he said, "Oh, everywhere." When I at once told him that he would consequently be called upon to add something to the lecture this evening he qualified his statement by saying that he had travelled everywhere in Brazil except that part described by Captain Bullock. We have, therefore, no one who is competent to criticize the lecture this evening. From the point of view of a lecturer that is a state of affairs which, no doubt, has certain advantages! No matter how astonishing are the statements which he makes, he can make them with complete confidence that they will not be contradicted. From the point of view of the audience it also, of course, has advantages, namely, that we all learn a great deal that we did not know before. Personally I used to think of Brazil hazily as a country from which nuts come. I know a great deal more about it now than I did then. The Araguaya basin appears to be still a somewhat savage country. Even the majority of the fish, as far as I can make out, displayed a number of very savage tendencies, from the fish that inconveniently puts up a spike for the unwary biped to tread upon, to the fish who leapt out of the water in their desire to gorge upon a carcase. Mr. Bullock also showed us what I thought was an admirable photograph of a forest fire, but said it was not a very good one. I do not know whether he was referring to the photograph or the fire, but I think I may assure him that all of us thought that both the photograph and the fire were very respectable. I wish that I could add something to what the lecturer has told you this evening, but I cannot, and I will conclude, therefore, by offering to Mr. Bullock, on your behalf, our most sincere thanks for his interesting discourse this evening. I would also congratulate him upon his success in exploring and making known such a very large area of such a little-known country.

THE USE OF WATERMARKS IN DATING OLD MAPS AND DOCUMENTS

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Read at the Afternoon Meeting of the Society, 18 February 1924. Folding plates follow p. 464.

THE idea of authenticating old documents by an examination of the watermarks of the paper is no new one. All who have had to do with early documents, whether as collectors, dealers, archivists,

or students, have naturally turned to the marks on the paper as a possible clue to the date or place of origin. Even in the eighteenth century Sir J. Fenn, when editing the Paston Letters, took account of the marks of the papers used and gave copies of many of them. In the nineteenth century Sotheby in this country, Midoux and Matton in France, and others elsewhere, attempted a more systematic study; but the vast number of the marks made the collection of data a slow and laborious process, and though much good work was done by Wiener, Heitz, Likachev, Bofarull y Sans, and others, it was only on the publication in 1907 of Briquet's monumental work, in which over 16,000 examples of paper-marks are figured, that material at all adequate for the solution of questions of date or authenticity was at last made available. It is needless to say that Briquet's work has been drawn upon to the fullest extent in the preparation of the present paper.

It might be thought that Briquet's labours had left little to be done by others in this field, but nothing could be farther from the truth. The vastness of the subject compelled Briquet to adopt a posterior limit of date for his great collection, and he fixed this at the year 1600, so that for later periods we have only incidental references in his work. Owing to the comparatively late appearance in the field of English paper-makers, he left their work entirely on one side; moreover he devoted his chief attention to manuscript documents, and allowed that there was still "infiniment à faire" in the collection and study of marks from printed books. It is hoped that the present paper, while offering little that can be called new, may induce others to cooperate in collecting the data still needed; and that those interested in the subject may be able to supply the answers to some at least of the many questions which to me are still unsolved riddles.

A few general considerations are necessary at the outset in order to gain some idea of the degree of precision of the evidence supplied by watermarks. It is not claimed, of course, that any date can be absolutely determined by this method: all that can be said is that it may supply useful collateral evidence in support or refutation of conclusions reached otherwise, or may at least bring the possibilities of date within comparatively narrow limits. Opinions differ on the important question of the length of life, if it may be so called, of individual marks, or of the moulds to which the devices were attached, but there seems little doubt that the latter would wear out pretty rapidly and have to be often renewed. (The date 1742 on many French papers used thirty or more years later proves nothing, as this date was given in obedience to an order of 1741 governing the French paper manufacture.) Briquet, after careful consideration of the statistical evidence, concludes that as a general rule the life of an individual mark may be put down as not over fifteen years. Did we possess only one dated example of a mark occurring in any given document, we could only say that the *probable* date of the latter

would lie between limits fifteen years on either side of the dated example. But when, as often happens, a large number of dated examples are available, we may fix the life of the marks much more closely; and if, further, a number of different marks occur in one book or document, the possibilities of the common use of all at one time are narrowed down still more considerably. A test of Briquet's conclusions has been obtained thus. A number of marks from dated books or maps in the Society's Library, of which closely similar examples are given by Briquet, have been taken at random and the divergence of date noted for each. In 37 per cent. of the cases, the divergence proved to be two years or less; in 50 per cent. three years or less; and in 84 per cent. ten years or less. If therefore the dating of any of these books had depended upon the watermarks, the *probable* error would certainly be less than ten years.

There is of course a bare possibility that paper might be held in stock for some years after making. An exceptional case is recorded of the use of a paper two centuries after it was made, and this might happen with a manuscript document requiring but a small amount of paper: the survival of a stock of old paper sufficient for printing is so improbable that it is hardly necessary to consider it. Briquet's figures are pretty conclusive evidence that no large stocks were held; thus, by comparing the *watermarked* dates of certain papers with the dates of actual use he found that in half the cases the interval was at most four and a half years, and in 92 per cent. of the cases twelve years or less. The great variety of marks often found in a single document points in the same direction. Much of the paper was made in small establishments, whose output was collected by agents for supply to printers at home or abroad, and the accumulation of large stocks would be extremely improbable.

In order to make the best use of our material it is not enough to establish the period in which a given mark was current, or even its place of origin as well. We must try to discover its normal range in space: for example, if a paper can be shown to have, normally, a quite restricted range, we shall feel it necessary to examine more closely than otherwise into the authenticity of a document on such paper, purporting to originate in a widely distant area. It is also desirable to note the usual sources of supply used by any given map-maker, for this may help us to judge of the correctness or otherwise of the ascription to him of an unsigned document. These points have been kept in view in the selection of the examples reproduced with this paper,* which will also illustrate the varying character of the marks used at different periods and in different countries. From time to time special attention will be called to the actual instances in which the marks have supplied evidence of date or

* References to these reproductions are given by numbers within brackets. It should be mentioned that a few of the earliest examples, shown for the sake of completeness, are taken from Briquet and other sources, but almost all the rest have been collected by myself from geographical books and maps.

authenticity. Some of them are also of interest as taking us behind the scenes, as it were, and giving an insight into the way in which early collections were brought together. Others when occurring on the end-papers of old bindings are useful as helping to establish the date of these. Thus the end-paper of a Ptolemy of 1597 in the Society's Library, in an old stamped leather binding, is marked with the pot, in a form recorded by Briquet once only, and that from the very year 1597; and the somewhat uncommon mark of the arms of Thann in Alsace (17), found on the end-papers of Pontanus's 'History of Amsterdam,' of 1611, is recorded elsewhere from 1602 and 1606. Both bindings may therefore with some confidence be pronounced contemporary.

The Earliest Types of Watermarks.—Many of the early marks represent common objects of everyday use (sickle (1), hammer, pincers, anvil (48, 49), ladder (57), scissors (4), and even the curry-comb (5), which shows a surprising identity with the modern form). Some even of these may have had an heraldic significance, heraldic charges being commonly chosen as marks. Thus the ladder, found only in Italy, may with some reason be supposed to point to the Scala family, and the anvil may perhaps be taken from the arms of Fabriano—cradle of paper-making in Italy—a smith working at his trade. Weapons, such as the crossbow (2), bow-and-arrow (9), crossed arrows (54, 89), are often met with.

Representations of animals or birds, real or mythical (10–14, 24), are among the commonest marks used by the early makers, especially in Italy, which long supplied paper to the rest of Europe—including even Spain, though this had itself learnt the art from the Arabs. Commonest of all is the bull's head (6, 7), first used in Italy, but soon copied in France and Germany. Its forms are legion, often in conjunction with the cross, crown or other addition, but certain broad types may be localized: thus in a simplified form, with eyes, but no indication of mouth or nostrils (7), it is always Italian, whilst a type with eyes omitted is always German (used originally, it is thought, by the Holbeins of Ravensburg).

Religious emblems, or marks with a certain symbolic significance, form another group which has been specially dealt with by Mr. Harold Bayley, who holds that even the pot (16, 22, 109), so hackneyed in later times, which gave its name to "pott" paper, may have originally carried an allusion to the Holy Grail. The Cross is met with in many forms (8, 15, 23, 32, 49, 57, etc.), alone or in combination, in later times mostly in conjunction with the I.H.S. (171). The simple Latin cross in an ovate shield is commonly met with in Spanish documents. The paschal lamb (45), emblem of St. John the Baptist, may have been taken at second hand from the insignia of places or persons which used it. The pilgrim with his staff (52, 59) was long a favourite mark in Italy, where "pilgrim paper" is still spoken of, and the cardinal's hat (51) was

entirely confined to Italy. The form with the cross above (69) seems generally later than the simpler form.

Armorial bearings, if used with caution, may supply a valuable clue to the place of origin. The bear of Berne (27), the crozier or pastoral staff of Basel, with or without the wyvern as supporter (28), the castle gateway of Ravensburg (177), the three crowns of Cologne (20), the *Kranzlein* of Saxony (26), the bend *potencée* of Champagne (21), are a few out of very many such marks. But they offer some pitfalls for the unwary, for a specimen with the stag's horns of Württemberg (88), does not, as it happens, come from Germany at all, but from Montbéliard, long annexed to Württemberg, though at a considerable distance from the Duchy. This is one out of many cases in which watermarks may help to teach history. When the coats are those of great families they may mean that the mills were held by grants from them or in some way enjoyed their patronage. Such are the oak tree of the Rovere, Dukes of Urbino (53), the six balls of the Medici (18), the six fleurs-de-lys of the Farnese (19), and others too many to mention.

The crown, one of the many marks which has given its name to a size of paper (30–33), makes a quite early appearance, and a primitive type occurs in the Paston Letters. Certain types are specially Italian (31), and when combined with a countermark in the corner are always Venetian. The tall " diadem " crown or " tiara " was in special favour in the early sixteenth century, some types being Italian (32), others German (33). Flowers and fruits (34–37, 58) are also among the early marks, the latter, once more, occurring chiefly in Italy. The fleur-de-lys appears from quite early times in the greatest variety of forms, either alone or in combination. Some are specially characteristic however, *e.g.* the *florencée* form of Florence (38). In a circle, sometimes with star above (39), it had a very long currency in Italy.

A series of early marks (21–25) shown on the first sheet of reproductions affords an instance of the near approximation to a correct date which may be gained by means of the marks. All occur in a small quarto volume of only fifty-four leaves given to the Society's Library by Sir Clements Markham—one of several early printed versions of the voyage to the Holy Land by Ludolphus de Suchen (or Südheim). It bears no imprint, and was thought by Brunet to have been printed at Venice quite at the end of the fifteenth century. All five marks can be closely matched from Briquet (though the agreement is less definite in the case of No. 23 than of the others, this being a mark long current with slight modification), and the specimens given by him are shown beneath the corresponding marks from Ludolphus, with the dates for which they are recorded. All fall within the period 1468–83, or, if 23 be discarded, 1471–83.* The provenance of most of the papers

* Two of the marks, the pot and the letter Y, also occur in the Paston Letters before 1483.

used can also be learnt from the marks, the first of which—the arms of Champagne—shows the paper to have been made at or near Troyes. The rest are either French papers, or papers commonly used in France or the Netherlands, so that Brunet's assignment of the book to a Venice press is shown by the marks alone to be most improbable, the use of foreign paper at Venice in early days being almost unheard of. The researches of modern bibliographers have shown that the book was in fact printed at Gouda in Holland in 1484, so that the conclusions drawn from the marks prove to have been quite near the truth.

Less definite but still interesting conclusions may be reached by a study of the marks in the famous Berlinghieri Ptolemy, first printed, as indicated by the dedication, and what is known of the printer, about 1480. It was re-issued at an unknown date with no change beyond the printing of a title in red on the recto of the first leaf (blank in the first issue), and the addition of a " registrum " at the end. In both issues most of the text is printed on paper marked with the Cardinal's hat in its earliest form, but as this remained in use through a good part of the sixteenth century it gives little help for dating purposes. The other marks are different in the two issues, the first showing, *e.g.* the scissors, in a form current about 1480–90, whilst the second has a variety of marks (eight in all) of which those that can be most closely matched elsewhere bear dates lying between 1514 and 1543. Thus the date of 1500 suggested by bibliographers as about that of the second issue seems likely to be somewhat too early. The marks are not here reproduced, but four of them agree closely with Nos. 48, 50, 51, and 57, the others being a ship, bull, crescent in circle, and crossed arrows in circle.

Italian Marks of the Sixteenth Century.—Another series of marks on the same sheet (43 to 59) is given because it not only shows well some of the general characteristics of Italian marks of the sixteenth century, but because all occur in the collection of maps known as Lafreri's Atlas, and (in conjunction with the imprints on the maps themselves) throw some light on the actual way in which the collection was brought together. It has been recognized that this is not to be placed on the same level with the more systematic collections of Ortelius and Mercator, being an assemblage of maps by various authors, many of them drawn and engraved in Venice, whilst Lafreri was established at Rome. But the watermarks bring out more clearly still the haphazard nature of the collection, showing that a large number of the maps must have been not only engraved but printed away from Rome. Nordenskiöld's suggestion that Lafreri may have acquired some of the plates from their original makers seems therefore untenable. The place-names and dates below the copies given are those to be found on the respective maps (the name being placed in round brackets when only arrived at by deduction), whilst the names added in square brackets are those of places from which the same marks have been otherwise recorded. It

will be found that of ten marks associated with maps drawn or engraved at Venice only three are recorded from Rome, while most are known to have been used at or near Venice. Lafreri therefore must have merely brought together into one volume (to which he added a title-page) such maps as were contained in his stock-in-trade, or were specially chosen from this by his customers.

In order to make all the maps of a suitable size for binding together it was necessary in many cases to add wide margins to the sheets as originally printed, and it may be noted that the watermarks on these margins (Nos. 48 and 54) also occur, the one on the title-page, the other on certain maps, in the collection itself—a sufficiently clear indication that the Atlas (at least the copy given to the Society by Lord Peckover) has come down to us in the form in which it was originally issued, and that the margins were not added later in binding for the owner of a fortuitous collection of maps.

Among the specially Italian characters shown by these marks we may note (1) the penchant for the circle drawn round the mark proper; (2) the common use of the star either above the circle or shield (as in 44, etc.) or within the shield (43); (3) the typically Italian forms of the shield (43, 57, etc.). Other marks from Italy are shown in Nos. 35–39, 68–71, those with the countermark in the corner (letters with often a trefoil above), being shown by this to be probably Venetian. The mark representing Justice with sword and scales (71, unfortunately rather indistinct) is by no means common, and only a much smaller specimen is given by Briquet. Another Italian mark, the pear-shaped fruit reproduced in the *Journal*, vol. 62, p. 282, is there shown to be of use in confirming the date of the newly found Contarini map of 1506. Since the account of that map was written I have found still another record of the use of the same mark, in an engraving by Andrea Mantegna of Mantua, who died in 1506; further confirmation of the date of the map, if such were needed, being thus supplied. In the Tower with crown and fleuron (40) we have another rare mark, to be found in Dürer's 'Apocalypse' of 1511, which has been used by Mr. Henry Stevens as evidence for the date of an unique early map, discovered by him some twenty years ago.

Typical French Marks.—Marks specially characteristic of France (at least after the earliest period) are the pot, the hand, and the grapes. The pot was used chiefly in Auvergne and Champagne. Of the vast number of forms of the hand, Briquet has shown that one (64) is characteristic of Genoa, another of north-west France (65), a third of north-east France (67), and a fourth (with crown above) of south-west France (112). Of the grapes (60–62, 84, 107), the earliest forms are decidedly the most artistic, the later ones becoming far too geometrically regular. The mark seems to have originated in north Italy, and to have spread to France, where it became so well established that it gave its name to

certain sizes of French paper, still recognized as "raisin." Placed near the edge of the sheet, as in the Servetus Ptolemy of 1541, printed at Vienne in Dauphiné (61), it may be localized in southern or south-western France, where it seems to have been a more or less general practice to place the mark in that unusual position. Other marks typically French are the St. Catherine's wheel (used chiefly in Auvergne; 75) and the sphere (in the Angoumois; 74).

Marks used in the Netherlands and Rhine Countries, 1570–1600.—With the marks found in the Italian Collection of Lafreri, it is of some interest to compare those met with in the atlases and maps of the great cartographers of the Low Countries, on whom the mantle of their Italian predecessors fell from about 1570 onwards. These marks, with others used in west Germany, are represented by Nos. 66, 72, 73, 76–104, and, as will be seen at once, are of a totally different character from those used in Italy. The pastoral staff or crozier (72, 73) was the special mark of Basel makers, and much paper so marked found its way to various parts of the Rhine basin, and other regions accessible by water-transport. The personal marks of the actual makers help still further to locate the papers with this mark. Thus the N H of No. 72 stands for Nicolas Heusler or Hüssler, whose special mark is added below, and he is also indicated by the house—a play upon his name—in No. 157. Similarly the tower below the crozier in No. 73 is a play upon the name Thurneysen, another of the great Basel makers. A favourite mark in this region is the monogram on an ornamental shield (66, 76–78, 80), and in this and other marks of the present group the frequent occurrence of the symbol resembling a Roman 4 (also much used as a masonic or merchant's trade-mark) is to be noted. It is held by Briquet to be specially indicative of an origin in the Rhine countries, particularly Lorraine. In No. 100 it is found in association with the Gothic letter P, a mark of much wider extension, both in time and space, the meaning of which has, however, never been satisfactorily determined, in spite of much discussion. The displayed eagle (72, 87, 93), either double- or single-headed, is also a mark long in favour in different regions. The fine specimen (93) occurs in the first edition of Mercator's Atlas, and being found on the map of America sometimes present in this, as well as on the sheet bearing the date of issue (1595) and other maps, lends support to the belief, sometimes challenged, that the America was really included in this issue, even if not in all copies. A careful study of the marks in all copies available would no doubt throw light on the precise manner of issue of the various parts of this first edition. Other marks on paper used by Mercator are the monograms 76–78 (77 being the earliest to occur), the serpent (94) and the smaller monograms (95 and 96). The last (96) occurs in all the covers of the set of big Mercator maps once existing in the University Library at Rome (see *Journal*, vol. 62, pp. 33, 138) and shows that, though those maps were originally published at

widely separated dates, the set in question must have been re-issued as a whole after all had been published.

The monogram 66 occurs on the excessively rare map by Hondius showing Drake's route round the world, which bears no date or place of publication. As the same mark is found in a book and map printed respectively at Cologne in 1600 and at Amsterdam in 1604, there seems no reason to adopt the suggestion (lately made to me by an American student of Drake) that the map was printed in England during Hondius's residence there before 1595. No. 97 is of a type which had a great vogue over a wide area for many years, with or without the interlaced Lorraine cross. Of its origin in Lorraine there is no doubt, the initials standing for Charles Duke of Lorraine and his wife Claude. In the simpler form it occurs in Wytfliet's work printed at Douai in 1605, and throughout the Mercator-Hondius Atlas of 1633. Besides the eagle (72, 87, 93) Nos. 80–82 are probably German marks, the F in 80 standing perhaps for Frankfurt.

Turning to marks of paper used for the maps of Ortelius (83–9, 91, 98–9, 101–4) we find a very different series, though including one (the smaller displayed eagle, 87) also used by Mercator. (The A C H of the Ortelius specimen almost certainly stands for Aachen, or Aix-la-Chapelle.) Most of the marks indicate a French origin, and the series as a whole seems to show that closer relations were maintained by Antwerp printers with the great paper-making centre of Troyes, than with the Rhine countries which supplied Amsterdam.* Of fourteen marks here reproduced from Ortelius, just half are almost certainly from Troyes. The makers here included (besides Denise, Nivelle, De Caroys and Jorné, whose names are to be read in the specimens shown) various members of the family of Le Bé, to which the reversed B's of No. 83 may with some probability be ascribed. The large crossed arrows (89), much used in some of the earliest editions of the 'Theatrum,' are almost certainly from Troyes, as they are found on the paper used for the local records. Another French paper is that with the arms of Montbéliard (88) already spoken of. The capital N (90), another mark used by one of the Nivelles, is not from Ortelius, but occurs on the British Museum copy of the rare map, "veuee et corige par le Seigneur Drach," reproduced in Mrs. Nuttall's volume 'New Light on Drake,' published by the Hakluyt Society.† Of the history of this map nothing definite is known, but the mark may perhaps help, in conjunction with other evidence, to throw some light upon it. Mr. Sprent of the British Museum thinks, from internal evidence, that the map may have been printed at Antwerp before 1590, and it may thus be the very earliest map made to illustrate the first English circumnavigation. It has been suggested, on the other

* The Plantijn Press used also a good deal of paper from Frankfurt.

† The specimen shown is borrowed from Briquet, as the mark is very indistinct in the map in question. It is there slightly smaller.

hand, that it was made much later to accompany a French translation of Drake's voyages; but the known use of Troyes papers at Antwerp about 1580–1600 (as shown above), and the fact that this particular mark was current, according to Briquet, between 1578 and 1602, lends decided support to Mr. Sprent's view.

Still another mark used by Jean Nivelle is the quaint one seen in No. 110. In connection with this mark Briquet quotes an old French verse about "le chien de Jean Nivelle, qui fuit quand on l'appelle," to which there is an evident allusion, although the personage referred to in the verse is not the paper-maker but a French nobleman of earlier days whose son took up arms in a time of disturbance on the side opposed to his father, and resisted all efforts to induce him to return to his duty.

Marks in English Books, Sixteenth Century.—So far we have had no occasion to refer to English papers or their marks, although paper was made in England before the end of the fifteenth century. No. 42 (borrowed from Briquet) is a mark used by John Tate, who set up a mill at Hertford to which a visit was paid by Henry VII. It is to be found in the Paston Letters as well as in the 'Golden Legend' printed by Wynkyn de Worde in 1498. But paper-users in this country long continued to depend largely upon the French mills, as they had from quite early times. The specimens 105 to 112, all taken from English geographical works, are mostly French, and other French marks found in England before 1600 include the crossed arrows (in the first issue of Saxton's County maps) and the hand of the type shown in No. 65. As above mentioned, this is characteristic of north-west France, while the hand with crown (112) came from south-west France. The specimen given is from Eden and Willes' collection of Voyages, the first general collection to be printed in English. The marks 108 and 111, however, are probably English—the portcullis as representing the Tudor badge (which now finds a place in the Westminster arms), and the fleur-de-lys because this type, with half of each petal shaded, is commonly found in English books for some time on from this period. The small pot (109) occurs commonly in England from this time on, but the paper probably came from Normandy. The fool's cap (120), so hackneyed a mark in the next century, already appears in England before 1600. Although originating abroad, the mark was adopted by Sir John Spielman (who started a mill at Dartford in the reign of Queen Elizabeth) and is to be found on a rare map by John Blagrave printed in 1596. One of the French marks in this group (106) gives an instance of a near approximation to true date afforded by a mark of somewhat unusual form. It occurs on the star maps published in 1590 by Thomas Hood, a Fellow of Trinity College, Cambridge. On a first rapid inspection of these maps (which are not often met with) the date escaped notice, but was very approximately fixed by a reference to Briquet, whose sole specimen of an identical watermark is recorded as from 1588.

Seventeenth and Early Eighteenth Century: England.—In the seventeenth century we lose Briquet's valuable guidance, apart from occasional historical excursuses, and any conclusions put forward must be regarded as more or less provisional and tentative. English makers now appear more often in the field, but it is not always easy to discriminate between English and foreign makes. A paper much used in England in the first half of the seventeenth century seems to have been of foreign origin, unless indeed the marks were copied by English makers from a foreign original. They represent a coat-of-arms roughly agreeing with one used abroad even before 1600 (114), and like this have apparently a representation of the "toison d'or" (golden fleece) below the shield (113). Several members of the House of Orange and Nassau (including William the Silent) were members of the Order of the Toison d'or, but the arms, though bearing some resemblance to those of Nassau, are not identical.* The mark, or its variations, is found in many English geographical works, including Purchas's 'Pilgrims,' Camden's 'Britannia,' Fynes Moryson's 'Itinerary,' and Foxe's Map of the Arctic Regions (in the last forming a clear link with the foreign examples, as it includes the tower omitted in the others). As Elizabeth, daughter of William the Silent, married Henri de la Tour d'Auvergne, Duc de Bouillon, it might be thought that a mark embodying quarterings both of Nassau and (possibly) La Tour, had a reference to this lady. But it appears, in an example given by Briquet, as early as 1594 or before the date of the marriage. As used in the paper of Captain Smith's map of Virginia (the very rare first issue) it is of special interest as containing the date 1610, and therefore proving that the first issue was *not*, as is sometimes stated, brought out before that year. Other marks specially characteristic of paper used in England in this century (in addition to the ubiquitous fleur-de-lys) are the pot (very common in a small form in the first half of the century, and becoming larger and more elaborate in course of time—122), the fool's cap in various forms (120, 121), the horn on shield with crown above (in a form identical with that now in use), and the pair of pillars or posts (119), which I have suggested as the real origin of the term "post" paper, usually attributed to the supposed post-horn. (That "horn" and "post" papers were distinct kinds is shown by a letter from Madras dated 1666 to which my attention has been called by Mr. Foster of the India Office.) Paper with the Royal Arms was used by the House of Commons until tabooed by the "Rump" Parliament, but of this early type I have not yet secured an example. On the Restoration the mark gained a new lease of life in the elaborate form found in books of about 1670 (116). The displayed eagle, in a

* A foreign specimen from 1591 has *two* lions passant in the fourth quarter, bringing the mark still nearer the arms borne by the Prince of Orange, though the lion and fess of the first and third quarters in these are transposed. The second lion in the fourth quarter was very soon discarded, perhaps from want of space.

somewhat new form (123), is commonly found in English books of the late seventeenth century, and for a limited period a somewhat remarkable mark, taken by Mr. Bayley to represent the five loaves and two fishes (124), was frequently used, but the makers' names attached seem to be all French (Jobert, Durand, Conard, Vaulegard, Mauduit, and perhaps also the singular name Homo which I have found on the fly-leaf of a book bound in 1705 in France for the Polish collector Count Hoym). Unless therefore the names are those of Huguenot refugees, the paper would seem to have been imported.*

A common mark of the same period is a monogram (117), for which I have as yet found no certain explanation, but which may perhaps be read as the letters I L P to be found in an unmistakable form in association with other marks of this century (118). The monogram is met with in both English and Dutch books, either alone or as countermark, but I am assured by a Dutch student of watermarks that it does not signify a Dutch paper.

In the early eighteenth century the Royal Arms were again used (125), and, being changed on the accession of a new sovereign, may give a useful clue to date, especially as the old form was sometimes retained for a year or two, coupled with the initial letter of the new ruler. The arms of the City of London (126) were another favourite mark, as also was the serpent in a circular coil (127). Both of these are often supplemented by a countermark in the corner of the sheet, and in this respect they show a decided affinity with a group of marks which now makes its appearance, and is generally associated with an excellent crisp paper (128–9, 134–5). The main mark may consist only of a letter or letters (noteworthy in many cases for the emphasis given to the serifs, which are carried above the line), or may be associated with a star in the other half-sheet, in addition to the mark in the corner. This last may be either a minute design (pair of scales, etc., etc.) or another letter or combination of letters, C M with T below being particularly common (127, 134–5, 137). This is one of many instances of two sets of initials appearing on the same sheet, one possibly standing for the name of the proprietor of the mill, the other for the lessee who worked it.†

* I have a strong suspicion that the mark may be merely a degenerated form of the French Royal Arms (coats of France and Navarre) surrounded by the collar of one of the Royal orders of the Saint Esprit and Saint Michel. (The chain most resembles that of Saint Michel, but the star below belongs to the Saint Esprit.) The undoubted arms of the French king, with a similar collar and star, were used by the Troyes paper-maker Journé before 1600, and continued in use during the first few decades of the seventeenth century. Towards the end of the same century the arms of France only were much used, surrounded by a similar collar (No. 140), which here is undoubtedly that of Saint Michel, though still with the star (or cross) as pendant. Examples of similar degeneration at the hands of workmen who did not understand the meaning of the coats-of-arms are not uncommon.

† This group of marks appears to have so close an affinity in some ways with certain foreign marks to be dealt with later (130, 131), that we might suppose the papers

These marks may supply a clue to the true date of an issue of Petty's Atlas of Ireland, originally printed in 1683, of which a copy was lately acquired by the Society. The only date to be found in it is that below Petty's portrait given as a frontispiece, but as it is there engraved on the plate itself, it would not be changed on a re-issue. That such was made is known by the inclusion, in some copies, of a dedication to Lord Shelburne, who only received that title in 1719, but this is not found in the Society's copy. Yet the watermarks (135–7) show pretty conclusively, when compared with the dated examples of this group of marks, that the copy can hardly have been printed before about 1720. The shield with the bend and countermark Beauvais (*i.e.* the Beauvais mill at Augoulême) points to a date round about 1730, paper with the name of the same mill, with a similar four-line bend (instead of the usual three-line), being found in use in that year, and, in conjunction with other marks, in 1729 and 1732. The G R (note the serif of the G carried above the line) is not conclusive in itself, as it might conceivably stand for Gulielmus as well as Georgius, but as the mark is constantly found otherwise in the reigns of the Georges, but not in that of William, such a supposition is quite improbable.

A paper used a good deal in England, especially for manuscript work, bore the horn on a shield or cartouche of fanciful shape (132), and might be thought to come from Italy, as it sometimes bears the word Vorno, the name of a village near Lucca; but the initials I V T, associated with some examples, seem to indicate that it came from the mill owned by Van Tongheren of Angoulême. This mark, which will be referred to again presently, seems to have held its ground down to the nineteenth century.

Seventeenth and Eighteenth Centuries: France.—In France we find many armorial marks in use in the seventeenth century. The Royal Arms as borne by Louis XIV. (France and Navarre) occur about 1670 in an elaborate form, with the collars of the two Royal Orders. The arms of prominent men like Cardinal de Bouillon (143) or Colbert (139) would naturally be used mainly when such men were at the height of their influence. As the Cardinal belonged to the family of La Tour d'Auvergne, the use of his arms in that great paper-making district is easily explained. One of the quarterings of his coat—the three *torteaux* of the Counts of Boulogne, was also much used alone, the *torteaux* being

above spoken of as commonly used in English books to be also of foreign make. Some of the small corner-marks are to be found also within the circles of the foreign marks, *e.g.* that resembling a pair of eye-glasses (compare 129 with 131), and another representing a leg or boot. Small corner-marks (*e.g.* a star) also occur in some of the foreign papers referred to. Another similarity consists in the way the letters (or some of them) are joined together by the use of a continuous wire (in some papers used in Spain the whole of a maker's name is similarly made by one wire). Further, the initials L C used in one case as a corner-mark are also found in an identical form in conjunction with the specially French mark of the grapes.

sometimes, however, replaced by *annulets* (141). Other common marks were the crowned L (138, probably for Louis *), the clock-face (142), and the mace; the grapes and the fleur-de-lys still remaining much in evidence also. Among the great makers were Colombier, Dupuy, and the Sauvades, all of Auvergne.

During the eighteenth century the Auvergne makers produced stout papers of large size suitable for the huge atlases then in vogue, and the marks most used were the rosary and cross (144; already met with on papers made by Colombier and Dupuy before 1700), the two-headed eagle (147, a form used in the Angoumois), the IHS and Cross in an oval (145), and, in the latter half of the century, the dovecot (146). For smaller-sized papers, the grapes remained perhaps the most common mark. The maker's names, now usually given in full on the other half of the sheet, include the Dupuys, Cussons, Richards, Tamiziers, Micolons, and Vimals of Auvergne, and Pigoizard and De Michel of the Angoumois. A special form of the fleur-de-lys, with another mark below (148), was in use in the latter area. An echo of the French revolution is to be noticed in the cap of liberty as used in Vaugondy's big Atlas of 1793 (149, 150).

Papers used in Holland, Seventeenth to Eighteenth Century.—The many geographical works printed in Holland in the seventeenth and early eighteenth centuries show us what were some of the papers most used in that country, but many, if not most, were probably imported. Dr. Enschedé of Amsterdam thinks that the manufacture of paper for which Holland eventually became noted, acquired no great importance there until the next century. The fleur-de-lys on a crowned shield (155, 158), eventually taken as the mark denoting, with slight variations, paper of Imperial, Super-Royal, Medium, and Demy sizes, had a great vogue, but the initials W.R. attached to many examples indicate that some was made by Wendelin Riehel of Strassburg. This mark was much copied, and Briquet quotes a document showing that paper so marked was made at Nersac near Angoulême for the Netherlands market. The bend as an armorial charge, originally representing the arms of Strassburg, occurs in various forms (154, 156), but soon settles down into that still used for "Royal" paper (156). For a time the fool's cap found almost as much favour as in England, but generally in a varying form. The huntsman with horn is often found (151), also the horn on a shield (160) and the crozier of Basel (157), whence much paper was

* An earlier series of marks, all of the same style, and all containing a crowned letter (placed between two fleur-de-lys within a crowned shield), have caused a good deal of perplexity and offer a problem not yet satisfactorily solved. The letters found are B, F, L, and R (or possibly K), but the puzzle is that the name of no French king or regent began with B, and whilst L might stand for Louis, F for Francis, and K (if such it is) for Charles (Karl), the L is found throughout the sixteenth and early seventeenth centuries (from 1509 on), whilst of the six kings who reigned between 1515 and 1610 not one was a Louis. The R or K is found in use from 1493 to 1682.

sent down the Rhine to Holland. The imposing mark (161) showing Atlas upholding the World, is found in various editions of Blaeu's great atlas, at least from 1648, indicating that the paper for the same was probably made specially to Blaeu's order. Other marks found in the atlas show the letters I B (*e.g.* the elephant, 159), which might be thought to stand for Blaeu's name, were not the initials fairly common among paper-makers, one of the most notable being Jerome Blum of Basel. Another fine mark found in the productions of the firm of Blaeu is the laurel wreath with the initials I S within (162), which may perhaps stand for Jacques Salmon, proprietor of a paper mill at Angoulême about this time. The Dutch lion with sword, and darts representing the seven independent provinces (166), might be thought to indicate a Dutch paper, but it too may have been used by French makers who supplied the Dutch market. Towards the 'seventies of this century the arms of Amsterdam, with lions as supporters, began a career which lasted over a century at least, but this paper is known to have been made very largely in the Angoulême district for the Dutch market at mills kept going largely by Dutch capital. Paper with this mark was used in England, France, and Germany, as well as Holland, and a certain chronological sequence may be traced in its varying forms, so that it is not quite valueless for dating. The forms with mantling (164) seem to have been generally the earliest (one occurs in Dapper's 'Asia' of 1672), whereas the eighteenth-century forms had mostly the plain crown. The date 1742 on one example (163) proves unmistakably its French origin, being inserted in obedience to the French ordinance of 1741, and the makers' names or initials, often given as countermarks, are a further guide. The Amsterdam arms are to be found on the paper of a Dutch MS. in the British Museum—a copy of Tasman's original journal kept during the voyage of 1642—and, in conjunction with other marks in the same MS., give a fairly close indication of the date of writing, about which there has been considerable uncertainty. The arms are of the style of No. 163 (though without the date) and the countermark gives the name of I. Laroche, a member of which family is known to have worked a mill at Angoulême about 1750. Another of the marks is the horn within a shield of the pattern shown in No. 132, and the associated initials I V T seem to point to one of the Van Tongherens, owners of one of the Angoulême mills in the early eighteenth century; they are to be found also in one of the volumes of Valentyn's great collection of documents relating to the Dutch colonies, published in 1724–26. A third mark is of the type of No. 115, so long used with hardly any variation, but the initials L V G below and the I V of the countermark, are those of Dutch makers of the eighteenth century, which begin to occur commonly from about 1730 onwards. These indications point consistently to a date for the writing of the manuscript between 1725 and 1750, and confirm the view of Prof. Heeres that it

was perhaps written after 1700, as against that of others who thought it nearly contemporary with Tasman's voyage.

Some German Marks.—It is impossible within the limits of this paper to deal adequately with the marks of German paper-makers (some of which have been already referred to incidentally), though some of the German mills, as those at Ravensburg, Augsburg, Bautzen, and various places in Baden and Saxony, were noted from quite early times. Coats-of-arms were much used, as in other countries, some being extremely elaborate. One of the simpler forms, which seems to imply a connection with Ravensburg, is given in No. 177, and another in No. 168. The style of 167 seems to imply a German origin, and Nos. 175–6 and 178 are all from the same German book as 177.

Later Dutch and English Marks.—In the early eighteenth century the Dutch lion appears in a new form within a ring fence (169), in company with an allegorical female figure bearing the hat of liberty on a spear, with the words "Pro Patria" above. I am told that "pro patria" is a term still used in Holland for a class of paper. It was especially used for MS. work (*e.g.* legal documents), or for the fly-leaves of bound books, and had a great vogue in this country as well as in Holland.

It is often exceedingly difficult to say definitely whether a given paper is of Dutch or English make. The Dutch papers were now coming to the fore, and the reputation in which they were held in the eighteenth century is shown by the mark "All' Olandese" which I have found on an *Italian* paper of 1764, showing that, even in the early home of paper-making, to be made after the Dutch style was thought a recommendation. In England the Dutch lion holding the hat of Liberty on a pole or spear (165) was for a time, it seems, the recognized mark of "foolscap" paper, until replaced by the figure of Britannia now current. With this and the plain fleur-de-lys (133) the present-day marks for "Imperial," etc. (roughly similar to the old mark 158), "Royal" (cf. 136, 156), and "post" (cf. 115) held the field at the expense of many of their former rivals, so that something at least of the pleasing variety of the old marks became lost. Even in England these marks are commonly associated with the initials of the great Dutch makers Villedary and Van Gerrevink (IV and LVG), both sometimes occurring on the same sheet, or one of them in conjunction with the name of an English maker (*e.g.* J. Bates), so that one might almost think that they had become common property among paper-makers. Another Dutch firm—that of the Honigs—does not seem to have catered largely for the English market. On the English side the famous firm of Whatman was already a serious rival of the Dutch makers.

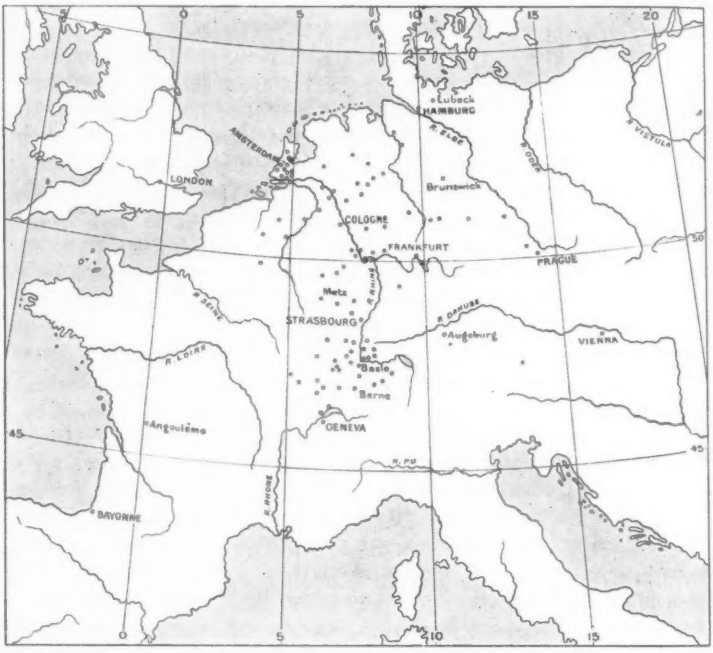
Later Spanish and Italian Marks.—In dealing with the later Spanish and Italian marks, it is not easy to disentangle them completely, so much Italian paper being used in Spain. In the late seventeenth and early

eighteenth century two closely allied forms are commonly met with in Spanish books and documents. One is an obvious development from the three moons or three circles of early Italian paper (131), and the other shows the arms of Genoa combined with two of the three circles (130). But here again caution is needed in assigning a place of origin, for there is documentary evidence (quoted by Briquet) that in the eighteenth century the paper with the "three O's" or "three rounds" was commonly made in south-west France after the "façon de Gênes" for export to Spain and the Indies. In another form—three crescents placed horizontally, with unusually coarse wire-marks—the mark does apparently denote an Italian paper, often exceedingly stout and firm, such as was used for collections of engravings, and almost to be identified by the touch. The fleur-de-lys in a circle (cf. 39) continues to be a common Italian mark, and we find a late variety of the crossbow (172), showing an entire change of style from the early form. It supplies the single instance I have met with where a tentative suggestion of Briquet's seems mistaken, as it appears in his collection as a solitary intruder among the older forms, with the suggested date 1602. It was found by him on the fly-leaf of a book of that date in what he thought a contemporary binding, but where the fly-leaf at least would appear to be much later. Elaborate designs with scrollwork (170) found considerable favour in Spain, but the most popular mark there in the eighteenth century appears to have been the bull fight (173). The arms of Lucca (174) are an unmistakable instance of an Italian paper used in Spain.

Besides the marks themselves there are other helpful indications, such as the position of the mark or its countermark on the sheet. We have seen that a position near the edge points generally to the south of France; similarly one in the very centre of the sheet was, according to Briquet, a characteristic of Genevan paper, whilst a countermark in the corner was, in old days at least, a mark of Venetian papers. The spacing of the two sets of wires to which the "chain" and "laid" marks are due may also be helpful, since in early days two periods of fine spacing were separated by one of wide spacing (see Nos. 36, 37 for examples of different types). But this part of the subject cannot now be enlarged upon.

Another branch of the subject which, by reason of its definitely geographical bearing, it would be interesting to pursue further did space permit, is that of the course of early trade as evidenced by the extent of country over which individual paper-marks were current. When it is possible to determine the centres at which papers bearing given marks were made, the great number of records brought together by Briquet permit us to lay down what we may call the "spheres of influence" of such papers, and this has been done for two marks of fairly wide diffusion in the accompanying two sketch-maps. The first

shows by means of small circles the principal places from which the crozier of Basel has been recorded, the second doing the same for the crowned hand of south-west France. The close clusters of circles around the respective districts of origin would suffice in themselves to indicate roughly whence the papers issued, and many of Briquet's conclusions are based upon a consideration of such regional distribution of occurrences. The importance of water-transport is particularly well brought out in the case of the Basel mark, while it will be seen that the two maps are more or less complementary, the spheres of the two



o Occurrences of Paper marked with Crozier, as recorded by Briquet.

papers hardly overlapping at all, except in the case of such a noted emporium of trade as Hamburg. It must suffice here to point out the interest of such a line of study.

It has been impossible in this paper to refer to more than a small proportion of the vast number of marks current in old days, even though attention has been confined chiefly to the three centuries 1500–1800. Enough has however been said to show that even a general knowledge of the subject may be of some help in authenticating documents or disposing of unfounded claims, and there are cases where such a general

knowledge may be of more help than even a thorough knowledge of a limited period only. Thus the mere fragment of a mark shown to me as occurring on an engraving, the date of which was in question, could at once be identified as part of the shield and crown of the type seen in No. 115, which was certainly not in use in the fifteenth century, when the original engraving was made. Again, a minute patch used in repairing a leaf of an Ortelius when last re-bound could at once be seen to contain a small part of the crown and " mantling " in the Arms of

o Occurrences of Paper marked with Hand and Crown, as recorded by Briquet.

Amsterdam, as found elsewhere from about 1680. It is thus important that students should acquire such a general knowledge of the whole period in which watermarking has been practised, before specializing on more limited periods, which may also be advisable in view of the tens of thousands of marks that have to be dealt with. In proportion as the data accumulate, the precision of the results will increase. If it be thought that the positive results here mentioned are of no very great importance, they at least show something of what may be done, and if we learn to use the help offered with insight and discretion, we

may no doubt find that really important points can occasionally be settled in this way.

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: The lecturer this afternoon requires no introduction to an audience of this Society. Mr. Heawood is going to tell us something of his researches bearing upon the use of watermarks in paper in dating old maps. He will be able to show, I think, that watermarks are of value not merely in dating old maps but also in testifying to their authenticity. He will probably give us as an example the case of the famous atlas of Lafreri which was compiled in Rome some time in the sixteenth century. Mr. Heawood will be able to tell us what he has learned with regard to that atlas from the study of the watermarks on the paper of which it is composed. I will not stand longer between you and the lecturer, but will ask him to proceed.

Mr. Heawood then read the paper printed above, and a discussion followed.

The PRESIDENT: Is there anybody present who would like to say something on the subject? I understand that the discoverer of one of the early maps mentioned by Mr. Heawood, namely Mr. Stevens, is here; perhaps he would like to say something.

Mr. HENRY N. STEVENS: I was extremely interested at seeing on the screen that very large tower surmounted by a crown, because some twenty years ago it led to the identification of one of the most interesting maps ever discovered. The circumstances are these: about thirty years ago at one of the leading London auction rooms I purchased a very imperfect copy of the 1513 Ptolemy, with only one map in it, which at the time, to my shame, I thought was the ordinary modern one of the world, the first map in the supplement to that edition. I put that book away in a cupboard, hoping some day to get a copy which it would help to perfect, and there it lay for some years. In due time another copy came along, and when comparing it with the first one I was suddenly struck by the dissimilarity of the two maps of the world, although at first sight they appeared similar. The original one had all the letterings printed from type apparently inserted through holes cut in the wood block, whereas the ordinary map of the 1513 Ptolemy is engraved throughout in Gothic letter. The curious point was that the map with the type lettering bore the name America, for at that time there was no printed map known, bearing that name, of authentic date earlier than 1520. Seeing that the 1513 Ptolemy map does not bear the name America, and that the same block of it was re-issued in 1520 still without the name, it seemed almost a paradox that the type-printed map bearing the name America should be earlier than the one without it. Still I had a suspicion in my mind that the type-printed map was earlier than the engraved one. I went to the British Museum and received the help of the late Mr. Proctor and other authorities, but we could not identify this type in any form whatever, until one day Mr. Proctor said that he believed it was Italian. We then got out some Rome and Venice books wherein we found similar types, which however on closer examination proved slightly different, so finally we gave up altogether the idea that the map had been printed in Italy. The name America suggested St. Dié as the place in which the map was originally prepared, and from the fact that it was not printed in St. Dié type sprang my idea that it must be anterior to the introduction of printing into that town, which we know was in the spring of 1507. At the time of which I speak, and it was con-

siderably more than twenty years ago, the large Waldseemüller map of 1507 in twelve sheets had not been discovered, and nobody knew what it was like. We could not identify the type of my printed map in any form whatever. We tried Strassburg and many other towns in Germany and France within a radius of a hundred miles or so from St. Dié, but entirely without success.

Finally we thought that possibly the watermark might be the key to the situation. In 1900 Briquet's book had not yet been published, and little could be learned about watermarks from other books. So I had a tracing of the watermark made and sent it to various correspondents in France and Germany, and a gentleman in Southern Germany wrote me that I should find a facsimile in Hausmann's book about Albert Dürer. We got that book out at the British Museum, and there sure enough was our watermark, and we found that it was used in the three great books of Dürer, 'The Passion,' the 'Life of the Virgin,' and the 'Apocalypse,' all printed in Nuremberg in 1511. No use of this watermark could be traced after that date. It will thus be seen that we immediately got back to where we wanted to be, namely a time anterior to 1513, in which year the engraved Ptolemy map was published. I examined the Dürer books in the British Museum, and there, printed on the very same paper, was apparently the identical type used on my map. But when we came to look a little more closely we found the Nuremberg type in the Dürer books was of a slightly later fount than that used on the map. We traced the type back gradually in other books in the British Museum, until we found that the type on my map was such as was in use at Nuremberg from 1501 to 1508. Further comparison of the strength of the impression of the type in various Nuremberg books between those dates appeared to indicate 1506 as the approximate date of the printing of the map. The whole of this identification thus emanated from that watermark. After that we found some historical evidence which also showed that something was done in the preparation and printing of the map prior to 1507. All these points tend to indicate that my printed map may well be the earliest to bear the name America and to show any part of the new world discoveries.

Mr. Heawood also said something about the use of watermarks as regards detecting spurious things. I had a very curious case which may interest you. About ten years ago I bought at one of the auction rooms a copy of Hakluyt's 'Principall Navigations,' 1598–1600, which was described as having the original leaves of the voyage to Cadiz. I purchased that copy for about £40, and when I took it home and collated it, I found the Cadiz leaves were in facsimile, so I sent the lot back to the auctioneers with a notification of the defect. A day or two later they wrote saying that their head cataloguer begged to differ; that the Cadiz leaves were quite genuine, and would I kindly say on what evidence I declared them to be facsimile; moreover, they had called in a special expert to look at the book. I wrote to say that they were quite wrong; that the leaves were certainly in facsimile and that I was quite prepared, if they would send their expert to see me, to convince him in two seconds that I was right. They did not however send him, but asked me to write and state the reasons for my contention. I replied that if the expert would hold the paper up to the light he would find one of the Cadiz leaves bore the watermark of J. Whatman 1804. They immediately apologized and said it was the finest facsimile they had ever seen.

I had another case. An American gentleman came to see me and brought with him a very fine impression of the Carwitham view of Fort George, New York. I think the date of it was 1750 or thereabouts, and I told him it was

a very fine copy but hoped he had not given much for it. He replied that he had given a long price, and added that he had bought it as an original. I said, "Well, it is difficult to say exactly what is an original and what is not, but this is a re-strike. If you hold the paper up to the light you will see that it has Whatman's watermark of 1809." It was an impression from the old plate struck off on a piece of modern paper. So there are three examples of how I personally have found the greatest advantage from the study of watermarks.

The PRESIDENT: It seems to me obvious that Mr. Heawood has brought before us this afternoon a subject which has hitherto enjoyed very little publicity, and we are very much indebted to him for having introduced us to so novel and at the same time so interesting a subject. There was a great deal in the course of the lecture which certainly was entirely new to me, and it would seem from what Mr. Heawood himself said that there are still matters connected with these watermarks which are conundrums to him. He referred to a particular monogram, for example, and pointed out to us that it appeared to have been made up with the letters "I L P", but he did not go on to tell us what the I L P stood for. In these days some of us might have jumped to conclusions which would hardly perhaps be justified by the antiquity of the mark. That is one of the matters which are still a conundrum to Mr. Heawood himself, but he certainly has, I think, told us enough to show the tremendous possibilities which lie before further research work in this particular subject. The only other contributor to the discussion this afternoon has certainly told us much which confirms the value of these watermarks in proving the authenticity of maps and documents. I think there is nothing more that I can say except to express, on your behalf, your gratitude to Mr. Heawood for the time and care which he has given to the presentation of the subject which he has put before us this afternoon.

AMERICAN DEPENDENCE ON FOREIGN PRODUCTS

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Read at the Meeting of the Society, 25 February 1924.

IT is not of importance to analyze the items of American commerce except as they may throw light upon the relations which the nation has, and will have, with the rest of the world. It is proposed to turn the eye of geography upon one factor of internationalism.

America has grown up through youth to maturity in a state of isolation and could not be seriously menaced, even to-day, by any hostile nation save in the free passage of ships across the seas. For long there were few people and limitless resources. The grosser elemental needs were met at home, and many of the finer things that go with high standards of living were left out. There was a continent of incredible richness to be developed, and during most of the nineteenth century the attention of the nation was turned inward upon itself.

Raw materials were produced on a vast scale, and there were expanding markets at home. There were coal and falling waters at hand, and labour in abundance was attracted from Europe by the opportunities open in a new land. Americans had aptitude for invention: hundreds of thousands of miles of railway were built, capital was accumulated, technical skill was developed, and without consciously willing it America became a manufacturing nation.

The early colonists and the citizens of the new federal union had a distinct preference to be apart. For this they, or their fathers, had come across the sea. Memory was active, and they recalled the restrictions which led them to leave the older home lands. They would not be overmuch hampered in religious belief or practice, even though they, or some of them, did not grant full liberty to their neighbour in the new world. They had escaped from narrow corners into the wide fields of opportunity, and they were in large measure free from European intrigue and strife. They could meet the red man, subdue the forests, and conquer bridgeless rivers, and rejoice in new burdens and dangers, but Europe was left behind.

Following generations of such experience, the advice of the first president, when he laid down his office, was naturally given and freely accepted as an American gospel and rule of life. One who marks the worthy tenacity of Britons in holding to much that is old, may remark that the child was following the footsteps of the mother, in that sole mode of safe progress, by which the new gradually follows the old.

Meantime, in that Atlantic lowland which fronted Europe and was the first foothold of Britain in the new world, commerce had begun. Before the New Englander and the Virginian were the inviting highways of the ocean. The shipmasters of Massachusetts sailed fearlessly around the world, and none better than they knew the soundings of the harbours of Shanghai and Hong Kong, Singapore and Sydney, Calcutta and Bombay, or better knew the shores of Africa, South America, or Europe.

The daring sailor and the clipper ship were followed in the nineteenth century by an interior development which dwarfed the importance of all outside relations. It was the era of the conquest of the Mississippi basin, which, joined to the endless prairies of Canada, is the richest unified region for human exploitation to be found in any continent. The movement of the sons of Britain from the seaboard to the Rocky Mountains was the greatest trek in modern history, and was perhaps the swiftest industrial conquest in all history.

There were thousands of miles of possible river navigation, and the ship has followed the explorers' canoe over interior waters equivalent in area to this island. There were endless prairies: fifteen hundred miles of flat lands which probably led a distinguished Englishman to the verdict that there is "no scenery in America." There were stubborn

wildernesses of virgin forest to be removed before the plough could do its work. In this area sixteen cities of the first order have grown, if we so designate communities that have each a quarter of a million or more people. Two dozen great American states have developed in this region, and a few venerable pioneers of the younger of these states are still living.

The result of this single century of expansion was not merely in population and new homes and cities; it carried with it a vast product of raw materials, far greater than home needs required. This surplus was available for export, and trunk lines of railway, which in the economic way levelled the Appalachian barrier, were burdened with freights moving eastward to the Atlantic coast. Coincident with this growing interest in foreign markets, there was accumulation of wealth, the progress of education, and a new desire for the products of Europe and of every other continent.

Thus during the later decades of the nineteenth century there was high stimulus to manufacturing industry. Among the raw materials was cotton, which not uncommonly was sent 5000 miles to Lancashire, to be returned in finished products an equal distance for purchase by those who had produced the raw fibre. This could not be a permanent condition. One might try to imagine Lancashire as a subtropical region of cotton-fields sending its product to Galveston or Rio Janeiro to be woven for the Manchester trade. There were at the same time growing home markets to meet the needs of eighty millions of people.

Abundance of power was available in coal and descending water. There were unharnessed streams and thousands of reservoirs in the form of glacial lakes; labour came in abundance from Europe and from Canada, or was awaiting training in the coloured and poorer white population of the south; English invention fruited in American ingenuity, among a people who have always sought to replace the toil of the hands with the efficiency of the machine.

Between 1850 and 1900 the greater part of our quarter of a million miles of railway came into being, and capital accumulated and was set to work in highly administered combinations.

The motives for building up foreign trade were many. The immense surplus of raw products could not be left to clog the home markets and depress the status of farm and factory. At first and for long, the selling of surplus products was purely incidental to the home trade, but this exchange, among forty-eight states, rich, populous, and spanning a continent, was of truly imperial dimensions.

With the progress of manufacture arose the necessity of importing raw materials to be worked up. To cite a single example, in a small urban community by the southern base of the Adirondack Mountains, nearly one-half of the American output of leather gloves is made. In

the lobby of its chief hotel might be found sellers of hides and skins from many foreign lands.

American foreign travel has been large for a period of at least fifty years. Millions of Americans have in this manner, directly or indirectly, acquired a desire for the fine handiwork and the fruits of the looms and the field, coming from every latitude and every country. The men of Britain have long gone out to the ends of the Earth bent upon business, civil administration, and exploration, or called forth by the demands of war. Britain was cosmopolitan, at home in Egypt, the Sudan, Western Canada, India, New Zealand, Australia, South Africa, and the islands of the sea. Americans meanwhile had to shake off that provincialism, which, being inevitable, need not have occasioned surprise or less worthy feelings in Europe.

The trade impulse has been reinforced by the race for modern appliances, by the desire for new physical comforts, and a growing taste for æsthetic pleasures, and in America the luxury of to-day has been swiftly metamorphosed into the necessity of to-morrow. Without premeditation, in the course of trade and other mutual intercourse, we have been forced out of isolation.

American foreign trade was long hampered by obstacles and infelicities incidental to our newness. We knew almost as little about Europe as Europe knows about America. Americans did not know foreign languages. Let alone the query whether Anglo-Saxons in any continent are ready students of foreign tongues, it remains that we were far away, lacking that interpenetration of communication and social movement which comes inevitably to the crowded peoples of Europe in their relatively small domains.

There was also the Yankee aggressiveness of the frontier, which believed that time was money and had no comprehension of people in the Orient or Latin America, to whom time is not money. The American trader was too forward in his attempt to do business in a half-hour, and neglected the amenities that must precede trade in many parts of the world. There was also little attention to the needs and tastes of foreign peoples, and thus the Englishman and the German, paying careful heed to such things, were awarded the business.

We had no foreign banks or credit facilities, knew little of customs or business law beyond our borders, and demanded cash. The result need not be described. Consular service was poor, administered too often by aliens or by Americans who were thus receiving a reward for political service. Finally America had little transoceanic shipping, and one looked in vain for the American flag in Liverpool, or on the Thames, in Havre, Hamburg, Bergen, Genoa, Hong Kong, or Melbourne.

Some recent events do not seem to show that this last handicap has been overcome, but in most of the limitations outlined above there

has been a vast change. The new development has come in the early years of the twentieth century, especially during and following the war. America was forced to develop toward its capacity, though there is no pretence that she rivalled the burdens or the sufferings of the British people. Voluntary service, by men and by women, both in restriction and in industrial production, assumed immense proportions.

Labour costs and prices have been largely equalized, as must appear in any present comparison of the two countries. The American observer notes a remarkable rise in the costs of commodities and service in Great Britain, and finds that America does not stand alone in the imperious independence of the working classes.

A considerable number of foreign banks have been established in Latin America and in the Old World, and several great banking Corporations now regularly seek the graduates of American universities, subject them to a course of special training, and introduce them to financial work in foreign lands. We have greatly widened our range of foreign study abroad, especially in Great Britain and France, and there has been material expansion in training in the French and Spanish languages.

A further noteworthy stimulus to effective foreign trade is found in the schools of business administration, founded in several of the greater Universities. In these new foundations the standards of instruction are not below the requirements of other schools in such institutions as Harvard University, Columbia University, and the University of Pennsylvania. Illustrative details are here cited for Columbia University, which in this field has seventy teachers, and offers instruction in accounting, banking, finance, foreign trade, commerce, merchandizing, and transportation. One hundred and eighteen courses are available, of which twenty-eight are courses in foreign trade.

The federal government influences trade, especially through tariff legislation and through its Bureau of Foreign and Domestic Commerce, and its general efficiency in recent years may be inferred from what is known in Europe of the executive powers of Mr. Herbert Hoover, the present Secretary of Commerce.

The purpose of the Bureau is to provide information, to relieve difficulties, and to remove some of the long-standing handicaps to American trade. About one million requests for assistance of this nature receive attention in a single year. Bad market conditions are noted, warnings are set forth against wasteful trade practices and poor sales methods, and knowledge is provided concerning foreign tariffs and a variety of foreign legal conditions.

Merchants receive printed data within ten days after the information leaves the foreign country, and news gathered by cable is released by the press and other agencies weekly to the ready knowledge of seven and a half million people. The Bureau has become a centre for educating

Americans in foreign life. It is a school of trade, economics, law, custom, and geography, all in one.

There has been, since the century came in, large progress in geographic education; much remains to be accomplished, but it may now be safely said that there is a wholesome consciousness of the existence and worth of geography in American universities. Geographers now regularly serve the Departments of State, Commerce, and Agriculture and demonstrate their usefulness in manifold ways.

With all these changes, recent years have seen increased purchase of foreign staples and specialities, and this has happened notwithstanding the Himalayan tariff walls which Sophomoric statesmen have erected on our boundaries.

There is coming in America a new understanding of the philosophy of trade, as voiced by publicists, economists, and financiers. The fallacy of the so-called "favourable balance of trade" is now recognized. Commerce cannot be one-sided, for all trade is virtually barter. In spite of all the machinery of credit which tends to obscure this fact, trade is for mutual advantage, and falters when this boon is denied. If something is sold, it must in truth be paid for in goods or in service. To make or try to make trade purely selfish is narrow commercialism, selfish nationalism, and impossible economics. The result of the selfish theory of trade is not in peaceful relations of recognized mutual advantage, but in ultimate friction and war.

Self-sufficiency, however good it may be in war, is bad in peace, and unjust to every citizen of the nation that stresses the doctrine. Americans are beginning to realize that what they buy is of more value to them than what they sell—otherwise they would not sell. Exports benefit the trader—but even this, with ultimate qualifications—while imports benefit the nation.

Many factors in the past have obscured the true nature of our foreign trade, and we now realize that if we export we must be mainly paid in imports. Times have changed, for Europe could once pay us for our wheat and meat in many ways, as with interests on British and other foreign investments in a new country that must have money for its development. We also received much foreign service in banking and shipping, and this condition in some measure still obtains. Newer Americans have sent much money to relatives in Europe, but with restricted immigration this source of European revenue will fall off. The gain to Europe through American travel has long been large, and may well increase in coming years. But in the main if we sell to Europe we must permit Europe to pay us in goods.

As an example of American dependence we may take the Iowa farmer, who is more than thirty hours from the Atlantic coast, is rich, self-centred, and thinks less about Europe than do the citizens of Boston or New York. Iowa was long ago defined as "cow, corn, and hog."

Like all definitions it contains only partial truth. At least, the Iowan goes far toward self-support, and might be expected to meet the round of his needs in sister states. He produces corn, pork, beef, dairy supplies, eggs and fruit, and might raise wheat and wool.

Cedar Rapids, Davenport, Sioux City, and Des Moines, if not internationally known widely, are comely centres of a worthy population; their people might use Elgin watches from Illinois, home-made toys, native apples and berries, and pottery from Ohio or New Jersey. But they do not so limit themselves. Economically and intellectually they are increasingly international. Corn and meat will buy what their young women are reading about in the universities and what their young men have perhaps seen in their period of foreign service.

These interior people have long had their coffee from Brazil, their tea from Ceylon, and their wool from Australia and the Argentine, whether it be spun and woven in New England or in Leeds and Huddersfield. They are familiar with silk from Japan, watches from Switzerland, gloves and ribbons from France, and may in time overcome the present stubborn American repugnance to some of the handiwork of central Europe in toys and other things. Cocoa and bananas come to Iowa prairies from Latin America, vases and carvings from Italy and the Orient, and thousands of domestic manufactures in which are the whole world's raw materials. From the toilet-making of the morning to the sleep of night, the Iowan is never apart from universal contributions to his needs.

Thus a rural state in the heart of America, its statehood going no farther back than to 1846, a mere infant in European measures of antiquity, is international in high degree though not yet fully conscious of it. Our thesis is that economic internationalism must eventuate in political internationalism, if a peaceful and civilized world is to survive, and that the American nation offers no exception. Trader, statesman and citizen must, in this cosmic field, move together.

If one supposes that America could isolate herself and settle down to a comfortable self-sufficiency in material things, let him examine the figures which we shall now offer. The classification of American imports for the year 1922 shows the number of general categories as follows:

Animals and animal products, except wool	119
Vegetable products and wool	405
Mineral products	294
Miscellaneous	56
Total classes of imports	874

If it be remembered that many of these classes are highly composite, it will be at once seen that we really bring in from all parts of the world several thousand kinds of things, and that our dependence is wide-reaching and unceasing. Here are substances and objects which,

in evidence or in disguise, enter into every hour of the life of our people and of all our people.

This may now be shown more forcibly by the citation of a number of examples. We shall make four general classes of imports, basing our divisions on the varying gradations of home supply and outside dependence. It will be seen that in no class are we in actual practice in a condition of isolated self-sufficiency.

In our first group the home supply is in bulk ample, but there are considerable importations to meet special requirements. Cotton offers a simple and important example. The United States produces about two-thirds of the world's commercial cotton, and her most uniform and valuable stream of export is in bales of cotton. Yet the nation imports raw fibres, to the value of $47,000,000, no doubt chiefly in the long-staple Egyptian product, needed in special American manufactures. Were we not tied to the Nile for fibre we should be still more under bonds to Lancashire for product.

The two great English-speaking nations share the greater part of the world's petroleum, and just now oil seems to be not a lubricant but a destroyer of machinery—of the political sort. The United States imports a value of $88,000,000 in crude petroleum, and no small amounts of a variety of the refined products of petroleum. Incidentally it may be added that the period of dearth seems by no means in sight, for three western states hold oil shales capable of yielding forty billion barrels of oil, a greater total than existed in the oil pools of the country before the first well was bored in Western Pennsylvania.

It is well known that America has the largest production of iron and steel, the Lake Superior region yielding at present 30 per cent. of the world's supply of iron ore. Yet in this field the import of steel amounts to $30,000,000, and of crude ore and pig iron to many millions more. Even steel plate and steel rails fabricated in foreign mills find their way across our borders.

When we turn to ferro-alloy metals, our dependence increases. We are poor in high-grade ore of manganese, which is vital in steel-making and must always be imported. We can produce chromite only at high cost, and we depend for it upon Rhodesia and New Caledonia. By reason of the war the German grip on tungsten was released, and Great Britain now controls 54 per cent. and the United States 35 per cent. of the world's supply.

America raises one-third of the entire tobacco crop, and yet in a recent year imported values of almost $74,000,000, mainly in the leaf, but including some of the products of manufacture. In wheat our crop ranges from 600,000,000 to 1,000,000,000 bushels, with a correspondingly variant range of export, but imports even of wheat exceed 20,000,000 bushels. A yet more surprising fact has to do with copper, of which we produce 60 per cent. of the total, and yet imported to

the extent of $67,000,000 in copper ore and in refined and unrefined metal.

The general mineral status of the United States appears in the fact that in 1913 the last normal year, of thirty chief minerals, the United States was first in the production of thirteen, in which were included coal, iron, copper, lead, zinc, silver, oil, gas, phosphate, and salt. It may be added that the late Franklin K. Lane, the highly esteemed Secretary of the Interior during a part of Mr. Wilson's administration, said, referring to our mineral resources, "We are the world's trustees." From other high sources of authority and outlook came similar utterances. We may freely admit that the translation of such exalted sentiments into forms of international mutuality may seem far away, but they may be hopefully regarded as a prophecy, as they are certainly significant of the sense of public responsibility which along with the doctrines of conservation has made hopeful growth in America during the last thirty years.

We now turn to a second class of commodities in which we have a large product, but still fall far short of our needs. Sugar is a conspicuous example in this group. We use about 90 lbs. per head, sharing the "sweet tooth" with the Mother Country, with perhaps a little higher rate of consumption. Towards this vast requirement we go a moderate way only, with the cane sugar of Louisiana and the beet sugar of several states, chiefly beyond the Mississippi River. No inconsiderable sweet product is derived from Indian corn, a recent year showing 800,000,000 lbs. of corn syrup and 230,000,000 lbs. of corn sugar. But our principal dependence is upon Cuba, Hawaii, and other lands lying beyond the salt waters, and there we expend $250,000,000 for about 10,000,000,000 lbs of cane sugar.

Much the same is our status in vegetable oils. We send 700,000 barrels of cotton-seed oil to the olive-growing countries of the Mediterranean, and we make considerable amounts of corn (maize) oil. We might conceivably supply ourselves in this field, but we should never so restrict ourselves. As a fact, therefore, we import about $60,000,000 in vegetable oils and fats, including $12,000,000 in edible olive oil, and $16,000,000 in coconut oil.

A large dependence, from which we have no possible escape, is in our demand for hides and skins. The home product is in itself vast, but falls far short. In 1922 the importation was $100,000,000, and in the two years directly following the war the purchases ran between one-fourth and one-third of a billion dollars. Here we doubtless pay tribute to every continent, including no small sums for tanned leather and finished leather products. Here are thirty-six classes of imports, and many of them are highly composite. We do not raise chamois, or kangaroo, and our capacity for the alligator product is not large. We must go far afield for every kind of leather, and now that we have no

more hemlocks to slaughter for their bark, we go to all parts of the world for the substances used in the processes of tanning.

The United States raises but a ninth or tenth of the world's wool, and imports to meet nearly half of the home needs; we punish ourselves with inscrutable severity in meeting these needs, by a monstrous tariff which "protects" the Montana sheep ranchers at the expense of every citizen of America. If smuggling is not promoted, the desire to smuggle is engendered in the worthiest minds; the production of shoddy, to be rewarded by high prices, is encouraged; and a woollen garment is likely to cost twice as much in New York as a superior product costs in London. Neither mutuality nor home prosperity is thus fostered, but it is at least significant and pertinent to this discussion, that America continues to buy the highly desirable British product, notwithstanding the difficulties which the politicians of Washington put in their way.

Potash, nitrates, and wood are further examples in this class of partial supply. As regards the two first named, some progress was made during the war, but the effort is economically not practicable in peace. In the matter of timber supply it is well known that we have made worthy beginnings in scientific forestry, and know the wisdom and necessity of conservation. Following the inevitable pioneer destruction of trees, and the original waste of the lumber kings, we now know that we are using timber several times as fast as we are growing it.

Great Michigan furniture factories persist, not because the Michigan forests still feed them, but by virtue of their early start and established reputation, while their raw material comes from the south, the west, and from foreign lands. Ten thousand tons of newsprint paper per day are now used in the United States, and our forests can supply only a part of the pulp. We depend on Canada and northern Europe for the medium of our daily knowledge of the world. We are still burning up our flax fibres, straw, corn stalks, and waste paper, and leaving to decay better logs than on the average go to a British sawmill. But we are slowly learning a new country's lesson of economy and mutual dependence.

There is a third class of essential things which we cannot produce, or produce in trivial amounts. Here, unless substitutes are found, our dependence is permanent. We shall not raise bananas or ivory, our production of tin and platinum will not count, and as for tea and silk, the cost of home production seems likely to be for all appreciable time prohibitive.

We take our examples first in the realm of foods. We use nearly one billion pounds of coffee per year, almost 10 lbs. per head; we cannot raise it, and for more than three-fourths of our needs we pay Brazil $60,000,000 per year. Satisfactory experiments in tea production have been made by the United States Department of Agriculture, but it is wholly improbable that the necessary costs and technique will ever be developed in America. Spices are in the prohibitive list as well as cocoa.

We could do without the last, for which we pay $32,000,000, but we shall never so hamper ourselves.

Many of the tropical fruits are raised in large and increasing quantities. Small products that may become large are dates, figs, and olives. Nevertheless our importations run to $44,000,000, of which $19,000,000 are paid for bananas alone.

Perhaps the major item in this class is rubber. Here again the two English-speaking nations hold the field. British capital produces nine-tenths of the plantation rubber, and America manufactures two-thirds of all rubber. Eighty per cent. of our rubber goes into automobile tyres. This comes of necessity when a single firm can produce more than 2,000,000 motor cars in a year, and when America in 1922 had 12,375,000 registered cars and trucks as against 2,275,000 for all other countries. Some of the American supply might conceivably be raised in the Philippine Islands, but this seems improbable if any normal scale of prices is maintained Here is an industry in which America has overwhelming predominance, the maker and owner of cars enough to convey simultaneously her entire 105,000,000 people, and yet she goes outside for the most typically essential part of the equipment.

We could produce silk, and here again our experiments support the assertion, but it is in no way probable that we shall ever develop the experience of the labour supply needed. Yet we import one-half of the raw silk that enters commerce, and pay for it in each year more than four hundred millions of dollars.

We have referred to certain important metals that fall in this class. Of tin we have virtually none, and yet it is vastly important as a container of food and in domestic utensils. It permits, in war and peace, world-wide transportation of perishable and vital substances. Our imports of tin ore and metallic tin amount to $46,000,000. Our own resources supply not one five-hundredth of our needs, which demand more than one-half of the world's product. Britain mines and smelts it and we manufacture it. As regards platinum, we appear to be in the same position of permanent dependence, and the same is with little doubt essentially true of nickel.

Our fourth class of imports may be dismissed with few words, for the meaning is plain but profoundly significant. There is a vast range of desirable things which we cannot produce because we are ourselves, that world of commodities that have form or colour or convenience or richness of meaning, because of race and tradition and developed styles and customs and long-inherited skill. We could not enter into these fields were we so foolish as to desire to do so.

We could make and do make toys, but why not let the children be educated in the life of the present and the lore of the past by something that ready American ingenuity cannot fashion, or if it can duplicate its form, cannot vitalize it? We can decorate pottery, but it will be our

own, and only a fraction of the world's wealth in this art. Tapestries, rugs, carvings, mosaics, plastic objects, paintings, and, beyond our own contributions to thought and feeling, the world's wealth in books and music. Some important advances toward self-supply have been made during and following the war. At the end of the war we were using per month 1,720,000 lbs. of nitro-starch for filling hand grenades and small bombs. We thought we must make it of tapioca, but our chemists found that they could produce it from Indian corn.

We long supposed we must rely on Germany for chemical glass. Yet a small city in western New York was even then making better laboratory glass. We were forced to use it and many laboratories now employ it altogether, and assert that it takes three beakers of some German brands to last as long as one of American manufacture.

The famous firm of Bausch & Lomb, of Rochester, New York, now import no optical glass, but make their own, although they are Germans by origin and were formerly associated with German firms in their production and traffic, and they, who ought to know, affirm that the American product is now equal to any other.

One further example pertinent to this realm is offered here, and offered in part as one sign of the enormous development which all forms of chemical industry have now attained in America—we refer to the coal-tar dyes. Before the war 5674 different brands were listed in the American Custom House. Of them we now make a large number. Our purchase of German dyes was, as a financial transaction, but a drop in the bucket—a few millions of dollars. But the dyes formed a key industry on which depended American industries to the value of three billions of dollars. Among these were textiles, leather, paper, paints, and inks.

In 1914 there were seven dye factories in the United States and a paltry number of workers, a little more than five hundred. At the end of the war there were considerably more than one hundred firms and more than two hundred million dollars invested capital.

It remains that, outside of key industries and a few great staples, we are and shall for ever be increasingly dependent on all the world for maintaining those standards of living and taste to which a great new nation, beginning on a remote frontier, has now risen.

Something more significant than mere trade analysis inheres in the facts which have been given. Imports, exports, fields, mines, forests, factories, soils, climate, ships, and messages under the water and through the air, blend with each other and with every human interest to tie up nations together, or, if human perversity wills it, to set them at defiance.

America is not, cannot be, and, we are confident, would not be, the exception, resting in any fancied security of isolation. American internationalism is inevitable. How and when it may reach its fuller development are not suitable questions in this discussion. But the geographer

is properly interested in all the plain implications of his science, and no science comes closer to the social problems of the race.

There has been in these stirring times an outburst of intelligent interest, a desire for knowledge and an opportunity for gain of which, being human, America has been conscious; and there are foregleams of a larger American life, which will grow clearer, whatever the swing of voting populations, or the current decisions of the makers of laws and treaties.

Behind trade and above politics, there are at work impulses of an ethical and idealistic nature. These are effectively promoted by travel and study in foreign lands, and such experience is now more widely diffused over the countries of Europe and of all continents than before the year 1914.

It may be proper to adduce a further fact, the wide interest of many millions of Americans in the foreign mission interests of their churches. We have in mind no sectarian propaganda, for chief interest now centres in total well-being, in moral, physical, social, and industrial training and organization. Many millions of dollars are annually spent by America in all continents, and in the background of this effort are some hundreds of thousands of young Americans who from this motive systematically study foreign lands. Such study helps to put America in contact with the geography, races, customs, climate, history, and problems of remote parts of the world. The writer cites a single example, of a contemporary in the university life of his youth, forty-five years a missionary in Burma. Close to British life in that part of the British Empire, decorated for his service by the King, he is the head of possibly the largest self-supporting mission in any land, of which one fruit was a school plant concerning which a high British official said, as he saw it, "This is not a school; it is Buckingham Palace."

Great Britain has wide—we may say—cosmic relations: it is at home in the world, and its greatness has nevertheless been solidly built on its conservative conviction and action. America spans a continent and has a hundred million people, who, if they move, must move together. It is a younger nation proud and strong in its growth, learning to handle itself in the wider spaces. It is a geographer's conviction based on the concrete conditions which in this essay have been briefly outlined, that in the normal geographic unfolding, petty nationalism, political intrigue, and the provincialism of a frontier development will not control American relations to the world. "There's a divinity that shapes our ends, rough-hew them how we will."

Before the paper the PRESIDENT (the EARL OF RONALDSHAY) said: You will remember that this was the evening on which we were to have had a paper by Mr. Lauge Koch on Northern Greenland, but Mr. Koch was, unfortunately, taken ill and had to undergo a slight operation. He was unable, therefore, to fulfil his engagement. I am happy to say, however, that we have

now received news from him that he is making good progress, and that he hopes to be able to give us his paper on March 24. In these circumstances we may count ourselves most fortunate in having succeeded in securing an eminent geographer from the other side of the Atlantic to step into Mr. Koch's shoes. Prof. Brigham is well known to English audiences. He has on many occasions given courses of lectures to the School of Geography at Oxford, and he is at the present time engaged in giving lectures both to that school and at the University of London. The subject which he proposes to discuss this evening is the question of international economic geography. He told me, naturally, that he would sedulously refrain from touching upon anything which could be described as politics, but I rather gathered that the gist of his argument will be that in the sphere of economic geography, at any rate, the time has come when the Monroe doctrine has broken down: in other words, that while during the past century America has been inclined to regard herself as a self-contained unit from the point of view of industry and commerce, she is now abandoning that view and is looking more and more to other parts of the world to build up a great international trade. Well, Prof. Brigham will now, I am sure, both instruct and entertain us by discoursing upon that subject.

Prof. Brigham then read the paper printed above.

The PRESIDENT: I do not know whether there is anybody who would like to add to the discussion of the questions which have been put before us this evening. If not, I would merely venture to express your thanks to our lecturer for the picture which he has painted for us of the way in which America at the present day is stretching out her hands in the sphere of commerce to other parts of the world. I must certainly congratulate him upon his great self-restraint, for during a great part of his lecture he touched upon subjects which bordered on the political, and I doubt very much whether any Englishman who had been discussing the subject of the lecture this evening would have done so without at least touching upon the relative merits of Protection and Free Trade. Our lecturer has certainly brought home to us the immense scale upon which America is able to do things as compared with relatively small countries like our own Motherland. The fact that there are 105,000,000 people and yet only one to every eighteen acres of land in America gives us a vivid picture of the immense size of that great country. It is a great thing for us to realize that this vast population living in that vast land is stretching out its hands towards other countries. We ourselves are perhaps a small country, but we are only too anxious to provide all those commodities which I gather America is clamouring for. Perhaps I may remind Prof. Brigham that an exhibition will shortly be held in this city, and I think I can assure him that if he and his friends will come over and see it both he and they will gain some idea of what the British Empire is able to do in the way of making good the wants of America. I offer Prof. Brigham, on your behalf, your great gratitude for the readiness with which he stepped into the breach this evening and gave us this most interesting discourse.

FURTHER NOTES ON TIME-MEASUREMENT FOR IRRIGATION IN THE AURES

M. W. Hilton-Simpson

IN the course of a paper published in the *Geographical Journal*, vol. 59, January 1922, I described the use of a sinking clepsydra, or "water-clock," in the Aures hills of south-eastern Algeria for the determination of periods of time in connection with irrigation by means of small canals. Last winter and spring, with my wife and children, I spent another five months in the same and neighbouring districts, in the course of which I have been able to add to my notes on this clepsydra, as well as to observe a different system of time-measurement employed for the same purpose.

In my former paper I referred to a clepsydra already described by Mr. W. J. Harding-King (*Geographical Journal*, vol. 50, p. 361). This consisted of a copper bowl perforated in the centre of its bottom with a small hole and fitted with a short vertical tube rising directly from this hole on the inside of the bowl. The bowl was placed upon the surface of a pail of water, in which it sank owing to the ingress of water through the hole and tube, the unit of time for irrigation being the period between the floating and the sinking of the bowl. Modern watches are, even now, distrusted for use in this connection. The vertical tube inside the bowl constituted a difference between the "water-clock" collected by Mr. Harding-King at Tolqa in the northern Sahara and the specimen I procured at Beni Ferra in the Aures, for the latter was fitted with no such tube, which Mr. Harding-King believed to be intended to steady the flow of the incoming water as the clepsydra sank in the pail.

Last winter I collected about half a dozen specimens of this type of water-clock, some of which are now in the Pitt-Rivers Museum, Oxford; one, an old copper specimen, from an oasis in the neighbourhood of Biskra, and the others from El Qantara at the south-western foot of the Aures *massif*. These latter are bowls of tin, of European manufacture, somewhat resembling a soldier's mess-tin, to which the vertical tubes have been fitted by the natives.

The Arabs of El Qantara gave me a reason for the use of the tube which, while scarcely so scientific as that suggested by Mr. Harding-King, is at least practical. In that oasis, when two or three friendly neighbours share, say, half a day's irrigation of their gardens by means of a "saqiya," or miniature canal, they are accustomed to apportion the time of such irrigation to which each is entitled by the use of privately owned "water-clocks," the sinking rate of which is, of course, previously known to each of the parties concerned. The "clocks" at Beni Ferra, described in my previous paper, were usually the property of the village council and were manipulated by an impartial "elder" in the presence of the farmers whose gardens were to be irrigated.

Now at El Qantara an ill-disposed neighbour, whose irrigation falls due just after that of the group of friends referred to above, and is measured by a different clepsydra, might well desire to curtail (to his own advantage) their periods of irrigation by surreptitiously enlarging the hole in the bottom of their "clock," thereby increasing its rate of sinking and correspondingly reducing the length of each unit of time for irrigation to which they are entitled. In the case of a plain tin bowl, without any vertical tube, this enlargement could readily be made with any pointed instrument in a very short time, and even so slight an enlargement as to be practically unnoticeable would materially affect the actual time the bowl takes to sink. The presence of the vertical tube, however, renders such tampering a much more difficult and lengthy task as well as easier to notice; especially when, as is often the case, old gun nipples are used to form the tubes in place of tin. Desire for protection against trickery, therefore, has been said by several of my native friends to have given rise to the use of the vertical tube in the "water-clock" as found at El Qantara and the oases of the northern Sahara. Mr. Harding-King, to whom I have submitted my notes, agrees that this explanation of the origin of the tube is probably correct.

In the spring of 1923 we visited the country immediately to the east of the Ahmar Khaddu ridge, a district with which I was previously unfamiliar. Here I found that, as in some other parts of the Aures, geographical conditions had given rise to the use of a system of apportioning the water supply which differs from that of the lower and more open country described in my former paper, and renders the sinking "water-clock" unnecessary. The ridge of Ahmar Khaddu, attaining a height of about 6320 feet above sea-level, is in reality a spur branching in a south-westerly direction from the hill known as Ras Tageshrirt, in the heart of the Aures *massif*, to the fringe of the Sahara in the neighbourhood of the oasis of Mshunesh. Its western slopes are steep, but its eastern side consists of a long line of frowning precipices overlooking the stretch of lower foothills and valleys which lies between Ahmar Khaddu and the eastern outwork of the natural fortress of the Aures, the Jebel Shershar. The narrow valleys in the western portion of these foothills are watered by insignificant streams, flowing southward from the watershed formed by Ahmar Khaddu to lose themselves in the Sahara.

The district lies, properly speaking, outside the natural walls of rock which have made of the Aures *massif* a kind of cultural island. No such formidable barriers protect it from the predatory Arabs of the desert as guard the *massif* itself. Its inhabitants, however, like those of the Aures, are Shawiya Berbers, but the great majority of them lead a nomadic existence. They spend the winter months with their flocks of goats and sheep encamped near the fringe of the desert. In the spring, as the time for the harvest approaches, they move northward to the

high-lying terraced fields, watered by rainfall alone, which they cultivate on the slopes beneath the eastern cliffs of Ahmar Khaddu and near the summits of the lower foothills. These fields are very numerous, but at the time of my visit many of them lay fallow as a result of a scarcity of seed occasioned by the drought of 1922.

Scattered among these fields are isolated stone-built dwellings which, abandoned during the winter, are repaired and used as residences in the summer. Villages are far less numerous than in the Aures proper. Each consists merely of a large *qal'a* or defensible granary, built of stone upon a rocky eminence overlooking a valley watered by a small stream. Around it are scattered but few huts, all built of stone in the Shawiya style. Most of the high-lying fields are situated at some distance from the *qal'a*.

In the days of border warfare with the desert tribes, therefore, the crops of these fields were exposed to a risk of capture by a sudden Arab raid before they could be safely stored in the defensible granary. Thus it became desirable to cultivate as much land as possible in the immediate neighbourhood of the *qal'a*; land which, lacking the rainfall enjoyed by the higher fields, would require to be artificially irrigated. The valleys of the district are, as a rule, too narrow to admit of cultivation on any but the smallest scale beside the banks of their streams. The Shawiya, therefore, in former times proceeded with infinite patience to the construction of terrace gardens.

The best example of this work I found at Ulash, where the son of the local Qaid pointed out to me with pride the results of the industry of his ancestors at some unknown date. The *qal'a* at Ulash stands upon the summit of a very steep slope of smooth rock shown in the accompanying photograph (No. 1). Wherever inequalities in the surface of this rock offered any opportunity of laying a foundation, the people erected lines of little vertical walls, one above another, running transversely across the slope. The space between these walls and the rock was then filled in with earth laboriously brought up from the valley below, presumably upon the backs of donkeys. Thus a number of terrace gardens, resembling a flight of gigantic steps, was built upon the steeply sloping surface of the bare rock.

Upon the hillside to the west of the *qal'a* are a few small perennial springs, at a higher level than that of the topmost terrace. Near to these a basin or reservoir was constructed, roughly rectangular in shape, measuring about 33 feet in length, 18 feet in width, and 6½ feet in depth; one side consisting of natural rock, and the others built of unhewn stones. The water of the springs, collected by night in this basin, is conducted to the terrace gardens in the daytime by means of a *saqiya*, or miniature canal, seen in my photograph, running transversely across the rocky slope beneath the *qal'a* and immediately above the highest gardens. The lower gardens are watered by means of branch saqiyas emanating

"SAQIYA" ACROSS ROCK SLOPE, ULASH

VERTICAL POLE IN IRRIGATION BASIN, AURES MASSIF

END OF FIRST AND SECOND PERIODS OF DAY'S IRRIGATION, TQUT

END OF THIRD PERIOD OF DAY'S IRRIGATION, TQUT

from this main canal. When it is desired to fill the basin, the hole in its wall through which the water flows out into the saqiya is blocked by means of a large stone wrapped in sacking, this plug being removed by means of a cord when the water is to be let out. When full it is said to take twelve hours to empty the basin.

The procedure at the distribution of the water is as follows. The owners of the gardens to be watered on a given day—or their representatives—assemble in the morning at the basin. No special official presides, but the owners cut a mid-rib of a date-plam leaf to the exact measurement of the depth of the water when the basin is full, and a cord of a length identical with that of the mid-rib. The centre of the mid-rib is found by doubling the cord; quarters and eighths of its length being determined by redoubling again and again. The divisions thus found are marked by means of strips of rag tied around the mid-rib, which is then placed vertically in the water (No. 2). The plug is now removed from the hole in the wall of the basin and the water allowed to run into the saqiya by means of which (with its branch canals) it is conveyed to the first garden to be watered.

The unit of irrigation is one-eighth of the depth of the water in the basin. That is, should a farmer have acquired by purchase the right to one-eighth, the water is allowed to flow into his garden while the water in the basin descends from one rag tied around the mid-rib to the next rag below it, the mid-rib being placed vertically in the basin.

The cycle of irrigation during the summer (in winter the system is not required) appears to be eighteen days; the cost of one-eighth of the water in the basin every eighteen days in perpetuity amounting to about 100 francs. At Teniet el Abed, in the Abdi valley, a village which I revisited this spring after an absence of ten years, a similar method of water distribution exists, but the unit is different. Instead of dividing the vertical pole into eighths, it is marked in divisions each representing the width of a man's hand as he grasps the pole in his fist. The unit, therefore, consists in the time in which the water in the basin, flowing out into the saqiya, falls one hand's breadth upon the pole, placed vertically in the reservoir as at Ulash.

After leaving the district to the south and east of Ahmar Khaddu, which we found remarkably interesting from an ethnographical point of view, we proceeded northwards to Tqut, crossing the ridge of Ahmar Khaddu by a pass known as Teniet Ferqus. This we did in a heavy snowstorm, so late in the year as April 15. The snow fell and lay for several hours, quite low down the slopes of the ridge. This must be very exceptional, but the winter of 1922–23 was a remarkably cold and wet one in south-eastern Algeria, thereby ensuring a good harvest after the very serious shortage of crops occasioned by the drought of the previous year.

Tqut lies in the wide spoon-shaped valley bounded on the east and

south by Ahmar Khaddu and on the north and west by the ridges of Zelatu and Kruma. The main stream of this valley, the Wad el Abyod (locally known as the Wad Rasira), enters it from the north through the chasm of Tighanimin between Zelatu and Kruma. Tqut lies a few miles higher up the valley than this gorge. The waters of the main stream, therefore, are not available for the irrigation of its extensive fields. Many of these are watered in summer from a large artificial basin, fed by a spring, situated in the village itself. In the distribution of this water a very primitive sundial plays an important part.

The day is divided, for irrigation purposes, into four parts. The first part commences when the rays of the rising sun first illumines a certain peak in the ridge of Kruma to the south-west, and terminates when they first shine upon a mark on a stone in the wall of a certain house. This stone is indicated by the right hand of the standing figure on the left of my photograph (No. 3). At this moment the second period commences, and continues until the sunlight strikes a mark on a stone in the ground beside a hut. This mark is less clearly shown by the left hand of the squatting figure on the extreme right of the same illustration. Then begins the third period of the day, which ends when the shadow of a vertical post, some 2 feet 6 inches high, beside the basin falls upon a mark on a stone embedded in the ground, pointed out in my last illustration by the official who presides at the distribution of the water. The vertical post is also shown in the same photograph. The fourth, and final, period of the day, commencing at this moment, terminates at sunset. During the night the basin is refilled by the spring.

In the subdivision of the above periods, a pole placed vertically in the basin is employed as at Ulash, Teniet el Abed, etc. This pole is marked by cuts to correspond with the four main divisions determined by the sun, these marks being used upon the occasions (rare in summer) when the sun is obscured by cloud. Each of these divisions is split up into eighths, similarly marked by scratches on the pole. These subdivisions, which form the unit of time for irrigation, are small, but the area of the basin is considerably larger than any I have yet observed elsewhere in the Aures, so that the water supply obtained while the water sinks but a short distance on the pole is correspondingly greater.

Landowners receive their water once in every twenty-four days; unless, of course, they have acquired by purchase from their neighbours the right to a more frequent supply. Each of these twenty-four days has a name. These, some of which are Arabic and others Berber, appear to be the proper names of tribes or individuals. The natives, who declare that their system of water distribution is so ancient that its origin is forgotten, believe that these names are those of the first (or at least of former) landowners whose gardens were watered on those days. Some of the names recur more than once in the list. For example, the first and second days, the tenth and eleventh, the seventeenth and

eighteenth all bear the name of the Ulad Hilal. In the opinion of the natives, this is an indication of the " strength " of that tribe or clan.

The Qaid of Rasira, who was present when I obtained my notes, was inclined to the belief that the method of irrigation and distribution of water in use at Tqut dates back to Roman times. It is known that Romans occupied the area, and the local Shawiya point out, as a proof of Roman industry, that the loose stones which cover the rest of the valley seem to have been removed from the land which they themselves cultivate to-day. At the same time, we must remember that practically everything of obscure origin in south-eastern Algeria, which is not regarded merely as the handiwork of " the people of early times," is attributed by the natives to the Romans, from whom, indeed, certain Shawiya tribes claim to be descended.

In many parts of the Aures, the seed of certain varieties of wheat and barley sown to-day is said to have an uninterrupted pedigree dating back to the time of the Roman occupation. At the request of an American gentleman I collected specimens of these varieties of seed and sent them to the United States Department of Agriculture for examination.

During our latest journey my wife and I have invariably been received by the French authorities in that spirit of helpful cordiality to which they have made us accustomed in the past. Once again I should like to offer them our heartiest thanks.

THE SURVIVAL OF THE AMERICAN BISON IN CANADA

F. H. Kitto, Engineer to the Natural Resources Intelligence Department of the Interior, Ottawa, Canada

FOR over a quarter of a century the noble bison was mourned as lost. True, sufficient numbers were preserved in parks or private enclosures to guarantee, barring unforeseen disaster, the actual continuance of the species for exhibition ; but as a wild animal in its native range it was apparently gone. Captive or semi-domesticated animals are at best but poor substitutes for the free. Usually they soon lose their vitality and diminish in both spirit and physique if not in numbers.

From time to time vague reports of fugitive bison wandering in various retreats beyond the frontier were sent abroad. Hopes of locating and preserving them were shattered time after time. Killed by Indians and hunters who defied the law, harassed by wolves and driven by forest fires into regions of scanty food and severe climatic conditions, these poor fugitives apparently succumbed to the inevitable. So often did failure greet all attempts to locate such wanderers that gradually their very existence was doubted and such reports styled as myths.

When proof of the actual existence of numbers of animals of the bison

species in the Peace–Athabaska–Slave rivers district was produced it was but partly credited. The animals were said to be an inferior species and not the true *Bison Americanus*. Since they were hiding in wooded areas they became known as the "Wood Buffalo."

Few persons had seen them in recent years. Their numbers were roughly judged at from 250 to 550, and their location was at first given as south of Peace river and east of Athabaska river. But little interest was manifested in their salvation. The general opinion was that they were not the true bison, and therefore of minor interest, and that in any case it would be hopeless to prevent their ultimate disappearance.

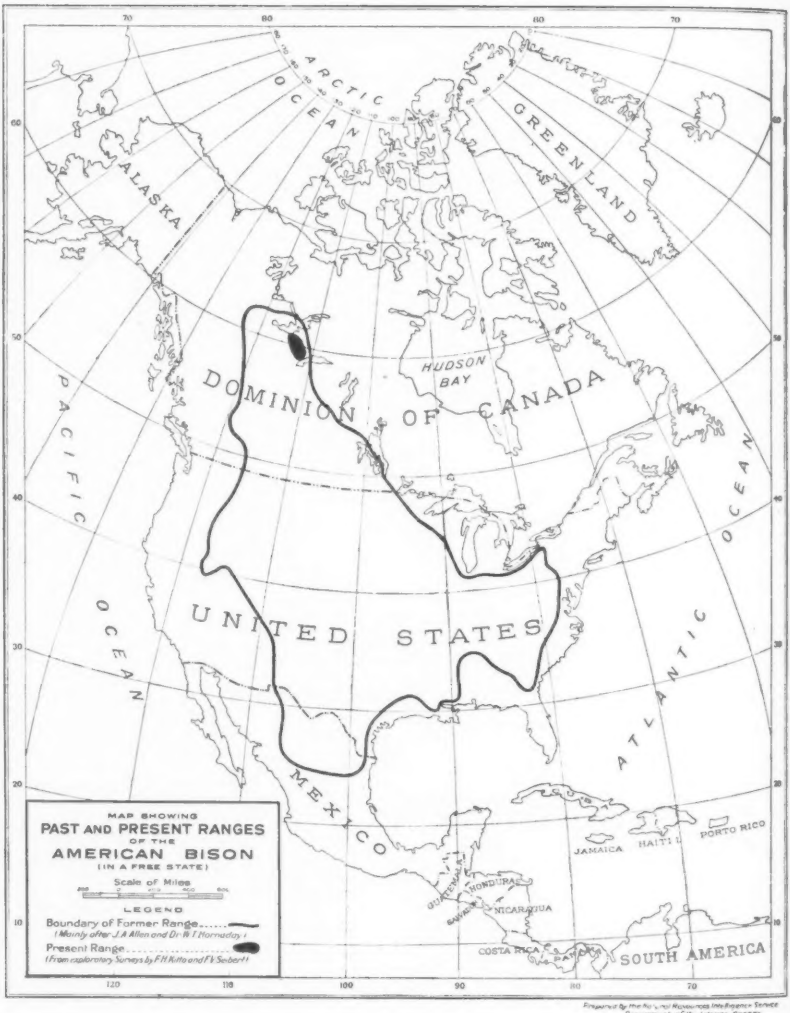
The Dominion Government, however, placed a permanent closed season for them on its game laws, forbade their molestation, and entrusted the Royal North-West Mounted Police with their protection. Later a couple of guardians or rangers were engaged to patrol the territory on which they were found and use all means possible to prevent their extermination. In the spring of 1920, having occasion to travel down the Peace and Slave rivers on my way to make explorations in the Mackenzie district, I was commissioned by the Superintendent of National Parks, who was then entrusted with the protection of these so-called "wood buffalo," to visit their range, gather what information I could in the few days at my disposal, and report to him. I experienced much pleasure in carrying out his request, and was fortunate in being able to verify claims that the animals were the true bison and that they were thriving and multiplying as of old.

The area in which the wild bison roam to-day lies in the northern part of the province of Alberta and the southern part of the District of Mackenzie. Alberta is the most westerly of the three "prairie provinces" of Canada. It lies immediately east of the Rocky mountains, and extends from the International boundary-line between Canada and the United States, the 49th parallel of north latitude, to the 60th parallel of north latitude. The District of Mackenzie forms part of the North-West Territories, and includes the area lying between the provinces of Alberta and Saskatchewan and the Arctic coast.

The geographical boundaries of the range might be roughly quoted as extending from lat. 59° N. to 61° N., and from long. 112° W. to 115° W. The physical boundaries, which will be found more accurate, might be quoted as follows: On the south by Peace river, on the east by Slave river, on the north by Great Slave lake, and on the west by the Caribou mountains. The range is thus hemmed in on two sides by large swiftly flowing rivers, on the third by the waters of a mighty lake, and on the fourth by an extensive plateau, which though scarcely deserving of its title as a mountain, forms an effective barrier. This plateau is flanked by Buffalo lake and Buffalo river, which drains northerly to great Slave lake, and Jackfish river, which drains southerly to Peace river. In this retreat, which nature appears to have provided

SALT AT FOOT OF SALT SPRINGS, WEST OF FORT SMITH, N.W.T.

CANADIAN WILD BISON


ARCTIC OCEAN
GREENLAND
ALASKA
HUDSON BAY
DOMINION OF CANADA
PACIFIC OCEAN
UNITED STATES
ATLANTIC OCEAN
MEXICO
JAMAICA
HAITI
PORTO RICO
HONDURAS
NICARAGUA
COSTA RICA
SOUTH AMERICA
MAP SHOWING
PAST AND PRESENT RANGES
OF THE
AMERICAN BISON
(IN A FREE STATE)
Scale of Miles
LEGEND
Boundary of Former Range
(Mainly after J.A.Allen and Dr. W.T.Hornaday.)
Present Range
(From exploratory Surveys by F.H.Kitt and F.V.Seibert)

for the purpose, I saw the lordly bison still roaming as monarch of all North American wild life.

This area, as earlier mentioned, lies in the Mackenzie drainage basin, which in extent is second only on the North American continent to the Mississippi. The Mackenzie river proper flows only from Great Slave lake to the Arctic coast, having a length of about 1300 miles. Its real source, however, is in the Rocky mountains. The Finlay and the Parsnip rivers of northern British Columbia unite to form the Peace. The waters of the Peace and Athabaska unite to form the Slave which empties into Great Slave lake, a mid-reservoir in the Mackenzie system. The total length of waterway from the head of the Finlay to the mouth of the Mackenzie is about 2525 miles, and the area of the Mackenzie drainage basin is 625,000 square miles.

The physical features bounding the range are themselves worthy of notice. Peace river is some 800 miles in length, and the part shown on the accompanying sketch averages nearly half a mile in width. The Athabaska is also a mighty river. Before its waters join those of the Peace they debouch into Athabaska lake. The country is here low and swampy and broken by numerous shallow lakes. Two principal channels drain this lake northerly to the Peace, namely the river des Rochers and the chenal des Quatre Fourches. The latter exercises the unusual trait of running in opposite directions at irregular periods. Should the Peace chance to be in flood and the Athabaska low, an overflow from the former reaches Lake Athabaska by way of this channel, thus reversing its usual direction of flow.

Slave river is about 280 miles in length, and has a strong steady current. For some 16 miles, between Fitzgerald and Fort Smith, a series of rapids are found which, having a total drop of over 100 feet, prove a barrier to navigation. Great Slave lake is estimated to be about 10,000 square miles in area. The so-called Caribou mountains are in reality a series of hills forming an extensive plateau which is as yet practically unexplored. On Hay river, which flows into Great Slave lake to the west of Caribou plateau, are the beautiful Alexandra and Louise falls, at an interval of 1 mile, and falling 105 and 45 feet respectively.

There are two routes to the home of the wild bison, each beginning at Edmonton and terminating at Fort Smith. Fort Smith is but a northern trading post, but it is the headquarters of the newly organized District of Mackenzie and the outfitting point for a tramp or ride through the range. It is on the left or west bank of Slave river, at the foot of the series of rapids mentioned and just within the District boundary, its latitude being 60° N. and its longitude 112° W.

From Edmonton one may travel 312 miles by rail to Peace River town, thence by boat some 300 miles down the great river whose name the town bears to Vermilion chutes, where a series of rapids and low falls

interrupts navigation. A 4-mile waggon road has been built to carry traffic below this obstacle. Other boats ply between the lower end of the chutes and Fitzgerald on Slave river—a distance of 260 miles A 16-mile waggon road then leads to the north end of the rapids and Fort Smith.

An alternate route, now almost exclusively followed, is by rail from Edmonton 287 miles to Waterways, a point on the Clearwater river a few miles above its junction at McMurray with the Athabaska. Connecting steamboats then carry one down the Clearwater and Athabaska rivers, across the west end of Lake Athabaska and down the Rochers and Slave rivers to Fitzgerald, a total distance of 292 miles. Thence, as before, the waggon road is followed to Fort Smith.

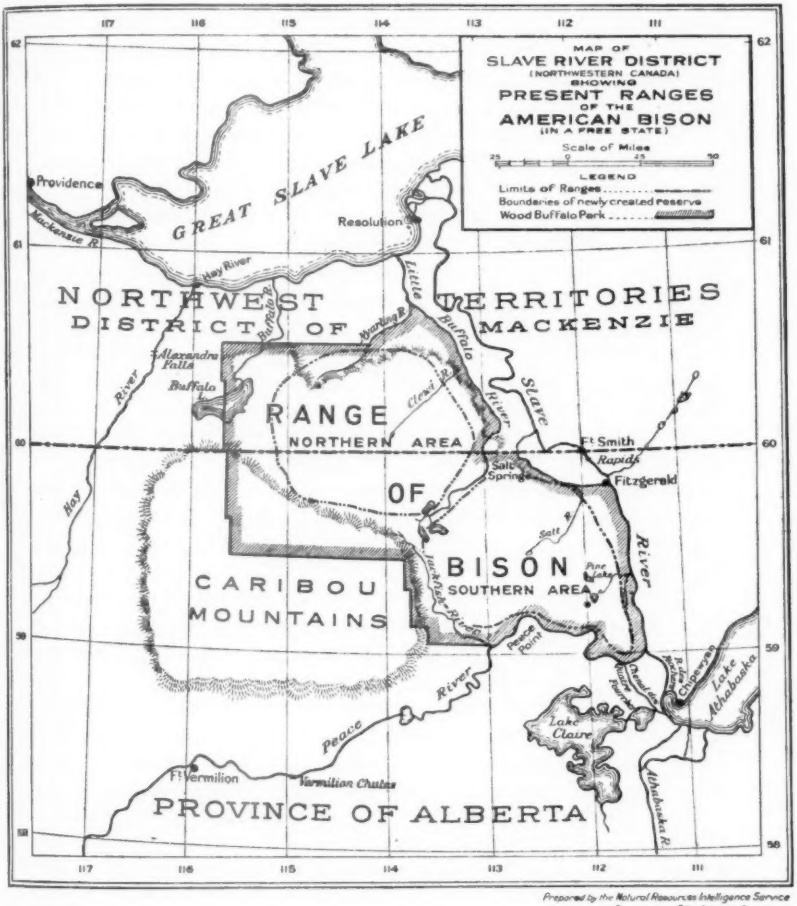
Geologically this district is an extension of the great Plains division of Western Canada with certain intrusions from the Laurentian plateau which lies to the east. The rocky outcrops of the Laurentian are to be seen at Chipewyan, near the west end of lake Athabaska. The boundary between these geological areas follows northerly along the Rochers and Slave rivers to Fitzgerald, where a westward extension of the Laurentian gives rise to the series of rapids already referred to. This intrusion continues westward for a great distance in the form of an escarpment and causes rapids or falls on numerous northward-flowing rivers encountered. The Alexandra falls on Hay river, and others still farther west, are on this escarpment.

The northern part of the range is very imperfectly drained by the Buffalo and Little Buffalo rivers, which flow into Great Slave lake, and the Nyarling and Clewi rivers, tributaries of the Little Buffalo. The southern part has somewhat better drainage, though still poor. Salt river, flowing into Slave river, and Jackfish river flowing into the Peace, are its principal streams. Buffalo lake, at the extreme north-east, and several smaller lakes are found, together with numerous streams, ponds, sink-holes, and marshes or muskegs.

The surface, on the whole, is fairly level, except where broken by the valleys of the streams mentioned. In places low rounded sand-hills give it a more rolling appearance. Generally speaking it is a wooded district, though, except for fringes along the Peace and Slave rivers, where excellent white spruce is found, the trees are rather sparse and small. White spruce and poplar predominate on the best land, with jackpine (*Pinus Banksiana*) on sandy knolls and black spruce in low wet areas.

The feeding-grounds of the bison are rich, level, park-like areas found at irregular intervals throughout the whole range. Wild hay and native grasses grow in profusion on such plains. Ample water is convenient. The sand-hills make excellent wallowing grounds, and are patronized during the fly season. The low wet marshes, which would detract from the value of this district as a cattle range, do not appear to embarrass the bison.

This district has also many other features of note: gypsum deposits, salt-springs, pot-holes, and underground rivers. Space does not permit of fuller description, but millions of tons of gypsum are exposed to view on the banks of Peace river, near Peace Point and at interior locations. Salt-springs are found about 30 miles west of Fort Smith. Huge deposits



Prepared by the Natural Resources Intelligence Service
Department of the Interior, Canada

of pure salt are constantly crystallizing, and supplies from this source have been used by northern traders and missionaries for decades. The waters of Salt river are rendered briny, and old skulls found here verify tales of this spot having been a favourite watering-place of the bison.

Possibly the presence of huge deposits of salt underneath the surface of much of this range accounts for the numerous peculiar pot-holes and disappearing rivers prevalent. As water reached the salt and carried it away in solution the overburden of earth caved in, thus giving rise to depressions. Some are bowl-shaped, others conical. They vary in width and depth from a few feet to possibly a hundred. Elsewhere the overburden has found support to maintain it, and various underground channels have resulted. Whole sections of small rivers, including the Nyarling and Clewi, disappear for stretches of half a mile or so. The places of vanishing and reappearing are usually made unnoticeable by the presence of small ponds, but the underground course of the river is easily traced by the continuance of its valley. These and numerous other features add to the interest of this remote district.

And now we come to the principal topic of our discussion—the bison themselves. In the spring of 1920, as previously mentioned, I patrolled this range. Time did not permit of making as full an examination as desirable, nevertheless I actually saw and photographed many bison, at close quarters, and gained much valuable information concerning their numbers, range, and condition. As a result of my recommendations the Government decided to set aside a large tract of country including the whole of this range as a bison reserve. Further exploration was decided on in order to determine the extent of these boundaries.

During the summer of 1921 I was again in this vicinity, and spent some time at Great Slave lake. Press of other work did not allow an opportunity of again patrolling the range, but I had an opportunity to talk with several old natives who were able to give much valuable information.

The following year, 1922, duties called me to Nova Scotia, and the fixing of the boundaries was entrusted to my fellow-engineer, Mr. F. E. Seibert. He travelled over considerable areas, including the more northerly parts that had never before been explored.

From our joint observations, verified by the evidence of many reliable residents of the districts, including the paid rangers, white and native trappers and hunters, missionaries, public officials, and others, we are satisfied as to the correctness of the following information:

True American Bison to the number of at least 1500 and in all probability 2000 are roaming in a free state in this district. Their range consists of two distinct areas, nearly equal in extent and as shown on the accompanying map. In size, strength, and vitality they are equal to and apparently excel the best specimens on record from early days. In colour they are darker than the former plains bison, but this is probably due merely to the northern and more sheltered range. In like manner furs of the same species of smaller animals are darker in the north.

Their numbers are increasing, many calves having been seen. The vigilance of the police and rangers has put an end to the desultory hunting

that was practised until recent years by a few Indians. Wolves still prey to some extent on them, but, except in cases where they manage to cut off a single animal, do not inflict serious damage. The feeding-grounds and range as chosen appear to be well suited to their requirements and of little commercial value otherwise. Other wild life found here includes moose, caribou, and a wide range of smaller fur-bearing animals. Three pleasing features are specially worthy of note: the fact that the bison in its wild state still survives; that it promises to continue and increase; and that its northern exile has improved it physically. In this connection it might be recalled that formerly a 1600-lb. bull was considered a big fellow, and that, with thousands to choose from, a 2100-lb. specimen was the largest American museum expeditions were able to secure.

A bull killed in 1910 near Fort Smith weighed 2432 lbs. Another, cut off and hamstrung by wolves just as the rangers arrived on the scene, weighed 2500 lbs. It is reasonably certain that bulls of 2500 lbs. weight are quite common in these herds. This clearly indicates that the bison in his new environment is not diminishing but rather increasing in size. His vitality appears to be unimpaired and his shyness and alertness to danger increased manyfold. In short, he has learned to take better care of himself.

By an Order-in-Council passed by the Government of Canada and dated 17 December 1922, the area indicated on the accompanying map and comprising 10,500 square miles has been set aside for all time as a national park and game sanctuary, prinarily for the protection and preservation of these survivors of the majestic bison. A resident superintendent with headquarters at Fort Smith, and experienced rangers with networks of trails and a series of cabins throughout the district, will see that protection is enforced. It appears reasonable to expect that the extermination of this noble species in his free state has been definitely stopped.

In a few years it may be expected that surplus stock will wander farther afield, and the lesson learned by the indiscriminate killing of early days will not be forgotten, so that these wanderers will spread over large areas of northern wilds. Further, the vitality of herds in captivity can, no doubt, be rejuvenated by the introduction of breeding stock from the native range, thus forestalling the possibility of decadence in their ranks.

In short, Canada has saved the bison. With a permit from the proper authority the traveller may see and photograph this monarch of American animals in his native range. He is more majestic than ever save for the indignity of being called a " wood buffalo " instead of *Bison Americanus*.

THE WORK OF JOHN CARY AND HIS SUCCESSORS

Sir George Fordham

Introductory Note to the Catalogue of the Exhibition of the Atlases, Maps, Itineraries, and other Geographical Publications of John Cary, Engraver, Map-seller, and Globe-maker, of London, and his successors (c. 1779–1850): from the collection of Sir George Fordham of Odsey, now on view at the House of the Royal Geographical Society.

THE name of John Cary is associated for nearly three-quarters of a century with Geographical publications, including canal plans, road-maps, maps, atlases, road-books and itineraries, as well as geological maps and sections and terrestrial and celestial globes.

With the exception of the globes, the exhibition now arranged, while not exhaustive, will be found to be very completely representative of his productivity, and of that of his associates and successors.

In the manufacture of globes he worked with his better-known brother, William Cary (1759–1825), who had a considerable reputation as an astronomical instrument maker, and in his cartographical work he was associated with others of his name, his brothers Francis Cary and George Cary, and his sons John and George. The business and, apparently, the whole stock of engraved plates were transferred to George Frederick Cruchley, of 81, Fleet Street, in 1850, who, in his turn, appears to have sold all this cartographical material in 1875 or 1876 to Messrs. Gall & Inglis, of Edinburgh.

Cary is first known as the engraver of a canal map, from a survey made in 1769, and presumably published in that year, and of a similar map believed to be of 1770. His first dated canal plan is, however, of 1779. A chart of the Atlantic Ocean appeared in 1780, and a map of Europe in 1781. In 1783 Cary commenced the publication of maps of London and its vicinity, thereafter numerous, and in 1784 appeared his first series of road-maps. In 1787 a very well known atlas of the English counties—quarto size—was issued, and in 1790 a similar octavo series appeared, both of which had a long range in time, through successive re-impressions. Cary's large-folio general and county atlases began to appear early in the next century (1808 and 1809), some of the individual maps having been engraved and dated as early as 1799 and 1801.

A large map of England and Wales and part of Scotland, in 81 sheets, was published in 1794, with a reduction in 1796. These maps ran through many re-issues. In 1832 another large map of the same area, in 65 sheets, appeared, which was re-issued later by both Cruchley and Gall & Inglis. It was on Cary's plates that William Smith drew and coloured his famous geological maps of England and Wales (1815, and reduction 1820), and of twenty-one of the English counties individually (1819–1824).

But perhaps John Cary is best known by his road-book, the 'New Itinerary,' which appeared in 1798 and went through eleven editions in the following thirty years. Cary was employed by the Government to measure the distances on all the post-roads of England and Wales, and it was on the basis of this exact survey that he published his 'Itinerary,' in rivalry with 'Paterson's Roads' (1771–1832).

A large-scale map of Russia, dated 1814, and a very fine map of India (issued in two editions, of 1824 and 1829) are notable works from the Cary press, and attention may be called also to the large-scale map of Oxfordshire, by Richard Davis (1797), and to the numerous maps and plans of London, and of the neighbouring country, and the road-maps of that neighbourhood, as well as to the very delicately engraved plans of the 'Road from the new Port of Milford to the new Passage of the Severn and Gloucester' of 1792, and to the large map of the Fens issued with Wells' 'History of the Drainage of the Great Level of the Fens,' in 1829.

The above indications do not adequately deal with the great mass of the output from the Cary geographical establishment, as spread over a long period of time, but they may be sufficient to justify the notable position occupied by that establishment in the comparatively modern development of British cartography.

John Cary's business was first set up at 188, Strand (at the corner of Arundel Street), in 1783; he is found in 1792 at 181, Strand (near Norfolk Street), where he remained for about twenty-eight years. In January 1820 his house and that adjoining (182, occupied by his brother William) were burnt down, and in July of the same year he dates from 86, St. James's Street (near the Palace), the last of his addresses. Soon after this removal, the firm-name of G. & J. Cary is introduced, and this continues on subsequent publications associated with the name of Cary up to 1850, in which year it appears for the last time in the London Directory.

When Cary's first set of road-maps ('Great Post Roads from London to Falmouth,' 1784) is compared with any sheet of the great map of France of Cassini de Thury, in 182 sheets, of which the earliest are dated 1756, it will be seen, I think, that Cary probably found his inspiration in respect of the art of cartographical representation of surface details in that monumental work, and it is not unlikely that he may have drawn for his 'Universal Atlas' on the 'Atlas Universel' of the Robert de Vaugondys, published in 1757, and on the work of other French cartographers.

But, however this may be, Cary shows much originality and often a very charming technical and artistic skill, and, taken as a whole, his work represents a considerable advance, as far as this country is concerned, in cartography as both a science and an art.

It is desired to bring to the notice of geographers, through the

display of a representative collection, illustrative of the various departments of his activity, the position which this cartographer may fairly claim in the advance of British geography, and the present exhibition has been arranged accordingly.

A catalogue of the Exhibits has been printed and a copy will be sent on application to any Fellow interested.

27 March 1924.

NEW PLANS FOR INDUSTRIAL DEVELOPMENT

The Doncaster Regional Planning Scheme.— Patrick Abercrombie and **T. H. Johnson.** Liverpool: University Press; London: Hodder & Stoughton. 1922. 12×10, pp. xii.+94. *Maps, Plans, and Illustrations.* 10*s. net.*

The Deeside Regional Planning Scheme.— Patrick Abercrombie, Sidney Kelly, and **Theodore Fyfe.** Liverpool: University Press. 1923. 12½×10, pp. 68. *Maps, etc.* 7*s.* 6*d. net.*

THESE two works are the first of what will probably be a fairly large series. They represent the latest development of the town-planning movement, and each deals with an area controlled by a group of Local Authorities and is, in form, a report to those bodies. The word "region" seems to be used, for want of a better, to indicate that the area is wider than that of a town-planning scheme; and probably few geographers would agree with the authors' use of the term. The Doncaster "region" is an area round that town, within a circle of about 10 miles' radius, whose unity is due to the fact that most of it is focussed on Doncaster as its market town and shopping centre. The Deeside "region" is a very different type of unit area; it includes the City of Chester and its immediate suburbs, together with the strip of land, from 1½ to 5 miles in width, extending from Chester along the western side of the estuary of the Dee; the total length is over 20 miles, and such unity as the area possesses is due solely to the river and the coastal route: it is likely to increase with the industrial development which the authors anticipate. Deeside is a "ribbon" area with no dominant focal point or civic centre, and as such is a striking contrast to the Doncaster district.

In each volume the authors begin with a clear description of the geographical features of the district, dealing with the physical features and relief, the natural resources (including a careful study of the mineral wealth), and the existing distribution of population, of industries, and of means of communication. This account is necessarily the basis of all the recommendations which follow it, and it is in itself a useful contribution to detailed geographical study.

The principal item in the planning is a detailed "zoning" of the land. Certain areas are marked out for unrestricted industry, *i.e.* as available for factories and works of all kinds and as the only areas on which heavy industries or factories producing much smoke may be established; on these areas no further residences may be placed. Other areas are allotted to agriculture in small holdings, others to residential developments of the garden city or garden suburb type; while in each district a large part of the whole is marked as neutral. The area "zoned" for unrestricted industry is in each case the lower land; on Deeside its upper limit is approximately the 50-feet contour. This allotment is based on the fact that this position places the factories down near the

waterways and railways and by flat roads, and thus in the most suitable places for the movement of their heavy raw materials and products. Also these lower areas are the most difficult to drain, and are unsuitable for residential development.

About Doncaster there is a considerable area which is less than 30 feet above mean sea-level. This was formerly all fenland, and part of it is still marsh. Under the whole extend the coal-seams of the "buried" eastward extension of the South Yorkshire coalfield, now actively worked at a small number of large collieries each of which employs more than 1000 men. All these collieries are now working in the Barnsley seam, and can reach a total thickness of from 33 to 37 feet of good coal. So far as is known from existing borings, these seams are here nearly horizontal and unbroken by serious faults. In these respects the Doncaster district has probably the most favourable working conditions of any British coalfield, although its pits are necessarily very deep. But it is clear that the extraction of this coal will let the surface of the lower land down below the level of high tide. There is a twofold danger of (1) the loss of considerable areas of fertile land; and (2) the formation of marsh and interruption of drainage with a resultant production of unhealthy conditions. The authors' plans for dealing with this danger would convert the area into another Holland of dyked meadows whose drainage is to be pumped up over the banks into the rivers or canals. The cost would be met by a tax on the coal raised. The plan is probably the best possible, and the West Riding County Council has already sought from Parliament powers which would enable it to carry out such a scheme; but it is well to note that the area which will ultimately be affected extends into the neighbouring counties of the East Riding and Lindsey, far beyond the area with which this scheme is concerned.

On Deeside there is no reason to anticipate any such subsidence; but the provision of a deep-water channel from the sea, and the reclamation of parts of the estuary shoals, would produce kindred problems. Below Chester the Dee has been straightened and embanked for a few miles, and here, in Sealand and Saltney, are areas of fertile meadow liable to severe flooding. Such land is suitable for heavy industry only if it is possible to obtain the firm foundation necessary for the buildings, railways, and roads required. The authors propose that the waste from the mines, quarries, and furnaces should be spread on the sites allotted to such structures so as to provide the foundation and at the same time raise the ground above flood level. This method has been employed in the Middlesborough area; it is sound where sufficient supplies of such material are available, and it is useful in disposing of such waste without producing the ugly waste heaps which disfigure so much of Industrial Britain. Elsewhere, as at Southampton, the same end has been attained by building a large concrete raft resting on the mud and anchored by piles driven deep into it. Such piles may be necessary even where waste material is used.

In regard to communications, it is of interest to note that there may still be railway competition in both these districts. Doncaster is an important main-line junction on the L. & N.E.R., and is also reached by a branch of the L.M. & S.R.; while Deeside has lines of both these systems and also of the G.W.R. Both districts can easily be made accessible to large sea-going vessels as soon as their economic development justifies the necessary expenditure. There are many detailed recommendations referring to the modification of existing roads and the construction of some new ones, which together form a well-conceived plan, taking account of both through and local traffic. In these the authors have paid due attention to the accessibility and preservation

of such places as the castles at Conisbrough and Flint, the picturesque gorge through which the Don reaches the low land at Sprotbrough, and other local amenities.

It is evident that in such plans as these the authors must accept the local government boundaries as they stand; but it is also clear that these boundaries impose purely arbitrary limits. In practice the inception and carrying out of any such schemes involves a close and frequent co-operation among the various local authorities concerned which may amount to an informal federation. And the schemes must ultimately raise the problem of adjusting the areas of local authorities in relation to the distributions here considered, and to the powers and duties of the authorities.

Underlying the whole of these plans for the development of such areas of future industry is an assumption that the industrial specialization of this country will continue to increase in the future as it has done in the last century. It is reasonable to assume that the coal under Doncaster will be mined, and that the district will become a great centre of manufacturing, though this may be achieved by migration of industry from other areas. It is not within the scope either of these volumes or of this review to discuss the general assumption; and we will only note that it is unproved, and perhaps incapable of proof otherwise than by experience.

Both volumes are well-illustrated by photographic views and diagrams, though some of the latter have suffered so much reduction that the small print on them is not easily legible. Each contains a large map of its district, reduced from the Ordnance Survey six-inches-to-a-mile map to half that scale, and inserted in sections as end papers. These maps show the detailed zoning, and enable the reader to follow all the recommendations clearly. The authors are to be congratulated on having produced valuable and practical suggestions for the utilization of the resources of each area and the betterment of the conditions of living therein.

C. B. FAWCETT.

REVIEWS

EUROPE

The Green Roads of England.— R. Hippisley Cox. Second edition, revised and enlarged. London: Methuen. 1923. 9 × 5½, pp. xii. + 196. *Maps and Illustrations.* 10*s.* 6*d. net.*

THAT this book has reached a second edition proves a demand for "popular" books dealing with ancient roads and earthworks; but it is important that even such books should conform to modern standards of accuracy. Mr. Cox's book is based in part upon actual field-work; but the area covered is great, and the author has relied far too much upon secondhand information, accepted without the careful scrutiny it requires. We believe that his main thesis is quite untenable: the hilltop camps are certainly not all of the same date as Avebury; and even if they were it would surely be an anachronism to imagine a prehistoric road system radiating thence to a series of earthworks protecting the seat of government. The evidence does not "point to the Stone Age as the period when the hill-forts were built"; on the contrary, it points to the Early Iron Age or the Late Bronze Age which overlapped it. It is easy to assert that "these hill-forts are obviously arranged systematically along the watersheds" when on the accompanying map only a selection of these forts is shown; and when amongst them are included earthworks of all periods

from the Early Iron Age to Norman times—more than a millennium! We are obliged to dissent from Mr. Cox's broad deductions, and many of his details are inaccurate. The "oval bank" near Sutton Veney (p. 31) is a perfect circle; it has been ploughed nearly flat, and the causeway, if such it was, has long ceased to exist; moreover it has no resemblance to an amphitheatre, and can never have been used as such. "Robin Hood's Bower" close by is stated to be Roman, but its age is unknown, and it may equally well be prehistoric, like South Lodge Camp, or even Mediæval. The Roman road is not "lost through Great Ridge Wood," but can be traced continuously right through it; it is not "found again in the same straight line near Witham Friary"; the dotted line by which it was shown there on the Ordnance Maps was taken from Sir Richard Colt Hoare's attempted restoration of its course, which, as he admitted, was purely conjectural. Not the slightest trace of it has ever been found near Witham Friary. The Knoll (945 feet) near Maiden Bradley is not the highest point in Wiltshire; Martinsell (947 feet), Milk Hill (964 feet), and Tan Hill (959 feet) are all higher, and these heights are marked on the one-inch Ordnance Maps. Because, like other chalk streams, the Deverill stream dries up in summer, its name is said to mean "Dive Rill," but this is a piece of folk-etymology only. The pre-Conquest spelling *defereal* shows the first part to be the Saxonized form of a Celtic river word (occurring in Dover [*Dubris* in Roman times], Andover, Micheldever, etc.). Cley Hill near Warminster is assumed (p. 21) to be the Æglea or Iglea where Alfred camped before the battle of Ethandun. But this was merely a guess made more than a hundred years ago by Gough "from the sound," and as Mr. W. H. Stevenson has said (Asser's 'Life of Alfred,' p. 270), "the two names cannot possibly be connected phonetically." Similarly Brixton Deverill cannot possibly have anything to do with Ecgbryhtes Stan where Alfred met his forces the day before; for Brixton is shown by early spellings to be the "tun" of Brihtric, who held it in the reign of Edward the Confessor. Six pages further on Mr. Cox places Ecgbryhtes Stan at Jack Straw's Castle, 7 miles from Brixton Deverill! The Stone of Ecgbryht cannot have been in both places. None of these suggested identifications are Mr. Cox's; they are copied from obsolete writers who flourished in the days before philology was an exact science. Their worthlessness has been convincingly demonstrated by Mr. Stevenson, whose classic edition of 'Asser's Life of Alfred' has now been published for twenty years; yet the same old exploded fallacies are repeated: and one must protest. O. G. S. C.

Unknown Sussex.— Donald Maxwell. London: John Lane. 1923. Pp. xiii. + 207. *Illustrated.* 15*s. net.*

There would seem to be no end to the making of books of this kind. One would have thought that every county in England, and particularly Sussex, had been described and sketched for the last time, and yet Mr. Maxwell does it once more, and brings the task off successfully. Two assets have stood him in good stead. First, his drawings in line and colour, especially the latter, are delightfully fresh, and are responsible for much of the charm of the book. Secondly, he has adopted a special theme around which to group the narrative of his rambles through Sussex scenes—the old Wealden iron industry. Once of national importance, it has left many traces upon the face of the countryside. In 1574 there were forty ironworks in Sussex, and their sites may still be traced both on the ground by their hammer ponds (which supplied the water power for blast and forge purposes), cinder hills, and excavations for

ore; and on the map by the frequent occurrence of names such as Furnace Wood, Ashburnham Furnace, Hammer Pond, Minepit Copse, and so on. The presence of iron "brasses" and "headstones" in the churches is another interesting relic of this industry. Mr. Maxwell has not, however, devoted himself to this theme to the exclusion of all others. Trusting in his readers' sense of humour he has dared to re-discover Brighton, retell some of the oft-told tales of smuggling days, and to describe the lost harbours of the Sussex coast. A less hackneyed chapter, "How Winchelsea planned New York," is an amusing account of a victory over a Bostonian, whom he was able to convince at last that town planning was not an American invention.

Memories of Travel.— **Sir Thomas George Jackson.** Cambridge University Press. 1923. 9 × 6½, pp. vi. + 172. *Illustrations.* 10*s.* 6*d. net.*

Sir Thomas Jackson has written these sketches out of a very full experience of travel in Europe during the last fifty years. The first trips he records were made in France during the 'seventies, the last is a visit to Constantinople in 1910. As an architect seeking for noble specimens of his art, he travelled leisurely through France, often compelled to supplement the train service by that out-of-date vehicle, the diligence. Thus he had many more opportunities than fall to the modern traveller for making the acquaintance of the French peasant at home. Looking back over the memories, he is struck by the extent to which the French have lost that spirit of liveliness and humour which they used to display in public, particularly around the inn table. The essays which deal with his travels in France, including a visit to the Grande Chartreuse, and Italy, are among the most delightful in the book, for a knowledge of the language and a keen sympathy enabled him to enter into the life of the peasantry, and to appreciate their attitude to the world. The chapters relating his Balkan travels lose much of this intimacy. In exchange for it, he warns us not to expect "stirring adventures by land or sea," and yet one hopes against hope: Venice under Austrian rule or Bosnia and Herzegovina would seem to promise something exciting, if not thrilling. But one's hopes are unfulfilled. The latter visit was made in 1893, when hotels on the best Viennese model had penetrated to Mostar and to Serajevo. Yet this is certainly no fault of the writer's. What one can expect from him, and what one does in fact receive, is a quiet, lucid account, with a pleasant old-fashioned flavour, of peoples and scenes, including, beside those mentioned, Assisi, the Borromean Islands, the Dolomites, and Salonika, as they appeared to a cultured and observant student. At times one feels, more particularly in the account of his sojourn in Constantinople, that the conscious and necessary effort to suppress architectural details as much as possible has robbed it of just that which most vitally interested the writer. It would be ungrateful to make no mention of the effective sketches, all too few, with which the book is illustrated.

The Riviera of the Corniche Road.— **Sir Frederick Treves, Bart.** London: Cassell & Co., Ltd. 1923. 9½ × 6½, pp. viii. + 316. *Illustrations.* 7*s.* 6*d. net.*

This book on the Riviera between Nice and Mentone, originally written by the late Sir Frederick Treves in 1921, makes pleasant reading. Though it covers the ground methodically, there is little of the guide-book in its composition. One turns from one chapter to the next in delightful uncertainty as to whether it will prove to be one of those entertaining sketches of past times and personalities, such as "A Prime Minister and Two Ladies of Grasse," a romantic interlude like the chapter entitled "How the Convent of St. Pons Ended," or a more

formal description of some mediæval stronghold. The history of this region, for centuries a bone of contention between France and Italy, is filled with alarums and excursions; Roman legions, Saracen pirates, Provençal free-booters succeed one another in these pages, whose atmosphere of treachery and bloodshed is now and then relieved momentarily by the fleeting glimpse of a troubadour, or the half tragic, half comic figure of a Mirabeau. Out of this abundant material, Sir Frederick Treves, with his lively style and ever-present humour, has succeeded in making the past live again in a manner which should awaken and grip the interest of the most casual visitor to the Riviera, as no orthodox guide could hope to do.

ASIA

Wonders of the Himalaya— Sir Francis Younghusband, K.C.S.I., K.C.I.E. London: John Murray. 1924. 9 × 6, pp. vii. + 210. *Frontispiece and map.* 10*s.* 6*d. net.*

Rudyard Kipling has given us a graphic picture of the strange unrest of spirit which impels men to explore. Can we not, many of us, recall times in our own lives when—

> "A Voice, as bad as conscience, rang interminable changes
> On one everlasting whisper day and night repeated—so:
> 'Something hidden. Go and find it. Go and look behind the Ranges—
> 'Something lost behind the Ranges. Lost and waiting for you. Go!'"?

The author of 'Wonders of the Himalayas' most assuredly could. Always was he hankering to "go and look behind the Ranges." We discover this before we have read many pages of the volume. Describing his passage of the first pass which he ever negotiated in the Himalayas he writes: "Then came the thrill of reaching the actual top and seeing 'the other side.'" A little further on we read: "all I wanted to do was to make a dash into Lahoul and back just to have a glimpse of what the country was like on the far side of that wall of the Himalaya." On another occasion when describing his approach to the Mustagh pass: "But what lay on the other side—that was the mystery;" and again: "we could not actually see the pass, but there it undoubtedly would be. And on the other side—What?"

The first journey described in this book—the first of the author's long series of expeditions and a comparatively simple one over well-known country, the valleys of Kangra, Kulu, and Lahoul—was to prove but a prelude to undertakings of a very different nature, expeditions which were to lead him into the innermost recesses of the great backbone of Asia, and to make his name famous for all time as an intrepid and resourceful explorer. The body of the book contains a graphic account of the last and most hazardous portion of the great journey from Peking to India in 1887, a narrative of which was first given to the public more than a quarter of a century ago in the pages of 'The Heart of a Continent.' And finally we are conducted by the author to those wild and distant fringes of the Chinese Empire which impinge upon the hem of the Indian borderlands of Hunza Nagar and Baltistan. The object of this journey, undertaken in 1889, was not merely exploration. This remote and shadowy borderland had been the scene of wild and lawless doings. The trading caravans that passed to and fro between India and Central Asia, travelling tortuously over the inhospitable tracts between Yarkand and Kashmir, had been harried and preyed upon by marauding bands of a virile and tempestuous people sallying forth from the rocky fastnesses of Hunza. And we are given a picture by no means uncommon in the neighbourhood of

the more distant outposts of the Indian Empire, of a lone Englishman armed with little beyond his own personality and the prestige derived from the character of his race, imposing peace and order where strife and discord reigned.

But for the most part this is a book about mountains and the fascination which they possess for those who have once felt their spell. And while the narrative of exploration in their untrodden recesses loses nothing of its freshness for the lapse of years since the expeditions were made, it gains much from the searchings of spirit to which these prolonged spells of solitude amidst Nature at her grandest gave rise. For it was during the journey which forms the subject of the latter pages of this volume, that the writer tells us he set out on the exploration upon which he has been engaged ever since—"the exploration of the very heart and soul of things, the discovery of the real Power, the inner Being, of which the outer features of Mother Earth's face, the plants and animals, and we men are but the expression." Throughout the volume we find evidence of a deeply religious spirit. Are the conclusions which he has reached in his search for "the inmost secrets of the world which are the supreme interest for men," identical with the mystic pantheism which is a characteristic offspring of the brooding thought of India? The reader must judge for himself. This at least is clear from the pages of this volume, that "the real Power" of his search is no aloof and distant deity but in the fullest measure God Immanent.

The volume is singularly free from slips, though the reference, on page 97, to Shigar as the capital of Baltistan is surely a mistake? It is many years since the reviewer himself travelled down the valley of the Shigar river; but his recollection is that Skardu, near the confluence of the Shigar and the Indus, is the capital, and not the village on the lesser river's banks.

R.

Into Little Tibet— H. M. Boulnois. London: Simpkin & Co., Ltd. 1923. 7½ × 5, pp. 256. *Illustrations.* 7*s.* 6*d. net.*

This book is the narrative of a journey from Srinagar to Leh, through Dras and Kargil, which Miss Boulnois made in 1922. As she recognizes, such a journey is not now an out-of-the-way achievement, yet her account, with its emphasis on the difficulties and dangers of the way, almost gives one that impression. This is no doubt also due to the zest with which she set out, determined, one feels, to meet with adventures. In this spirit, every incident was recorded in her notebook. Though the journey itself was uneventful, apart from the usual troubles which attend travellers in such regions, the book is of interest for the descriptions of religious ceremonies and social life in Haemis and Leh. Unfortunately, it is a difficult book to read. The jerks and twists of the author's style, and the general attempt to convey impressions vividly—mainly by omitting verbs—are confusing and make it difficult to follow the narrative. The introduction at odd moments of passages explanatory of Buddhism adds to this confusion. The book is illustrated with photographs, and water-colour and pencil sketches by the author.

The Dravidian Element in Indian Culture.— G. Slater. London: Ernest Benn. 1924. 8 × 5, pp. 192. *Illustrations.* 10*s.* 6*d. net.*

This is a very interesting and original little book. Interesting in virtue of its subject, and the style and manner in which it is written, original inasmuch as the author's object is to show, contrary to the opinion generally held, that the culture of India is fundamentally native of the soil, and is not chiefly due to invading peoples from the north-west, the so-called Aryans.

After a short account of the Dravidians and Aryans, the antiquity of Dravidian civilization is supported by arguments drawn from linguistic and archæological sources. So far as Dravidian civilization was due to foreign influences, it was overseas from Mesopotamia and Egypt that they came, not from the north-west. In fact, at the time of the Aryan invasion Dravidian culture was superior to that of the Aryan. This is supported by the important influence on its evolution exercised by religious ideas, and by the dominance of a priestly class or caste. Although evidently impressed by the views of Elliot Smith and Perry in their theory of a Heliolithic culture spreading from Egypt to the East, Dr. Slater points out that there is no such association in India between agriculture and mythical culture heroes as that theory supposes. The inference is that the Dravidians had begun the cultivation of rice before a sea contact with Egypt was established. Spinning and weaving may have been introduced by them, and this may explain the sacred cotton cord worn by the Brahmans. The author's sketch of Dravidian culture is based on several years' residence in the Madras presidency, during which time he brought to bear on the native population a keen observation and sympathetic interest. As the result of his observation and experience he concludes that Dravida is at once the part of India where the most ancient culture still survives, and the part which is in closest touch with the twentieth century. E. A. P.

Petra : Perea : Phœnicia.— The Rev. A. Forder. London and Edinburgh: Marshal Bros., Ltd. 1923. 10 × 7½, pp. 112. *Illustrations.* 7*s.* 6*d.*

This book, printed by the rotary photogravure process, contains about 130 excellent photographs of Petra, of Trans-Jordan (Perea), and of Syria (Phœnicia), many of them rather small, but all beautifully reproduced. But the text which accompanies them is of little value. The author's style may be judged from the opening sentence: "Petra, like a will-o'-the-wisp, has lured many to its rocky bosom": his accuracy by the statement that it has, after the war, become more difficult and dangerous to visit these places. There is little order or arrangement: Nabatæan and Roman monuments are labelled with one monotonous adjective—"old-time"; and there is no hint that the "rose-red city" has been studied, mapped, and described by competent scholars.

AFRICA

The Tomb of Tut-ank-amen.— Howard Carter and **A. C. Mace.** London: Cassell. 1923. 9½ × 6½, pp. xxiv. and 232. *Portrait and Illustrations.* 31*s.* 6*d. net.*

In view of the many accounts that have appeared in journals and periodicals of the discovery in Egypt which has aroused unparalleled interest and curiosity, Mr. Howard Carter, with the assistance of Mr. A. C. Mace, assistant curator of the Metropolitan Museum of Art of New York, has no doubt acted wisely in publishing a first-hand record of the search for, discovery and opening of the tomb of King Tut-ank-amen. This discovery justly ranks as a great archæological triumph, and is a fine tribute to Mr. Carter's prescience, determination, and skill. In this work he was continuously encouraged and assisted by Lord Carnarvon, whose death at the very moment of success was a veritable tragedy. The work is appropriately dedicated to the memory of his lordship, and contains a brief biography by his sister, Lady Burghclere.

The book takes us to the opening of the sanctuary when the magnificent shrine covering the sarcophagus was disclosed. The sarcophagus and its contents have yet to be revealed and described. What part Mr. Carter will take

in this, the culmination of his discovery, must depend on the results of the legal proceedings now pending in consequence of his dispute with the Egyptian Government. That he should be deprived of the fruits of a discovery due to his archæological knowledge and experience, and indomitable perseverance, seems unthinkable, and it is sincerely to be hoped that the quarrel may soon be amicably settled.

The feature of this work is the series of fine plates, seventy-nine in number, illustrating the most remarkable of the objects found in the antechamber of the tomb. Several of these have already been figured in the press and thus become familiar to the public. Here however will be found a thoroughly accurate and detailed representation of these objects, and their beauty and value may thus be properly appreciated and understood.

It will be a subject of unending regret if Mr. Carter should be unable, owing to the action of the Egyptian Government, to give a similar account and description of the contents of the sanctuary, which may be expected to even surpass in importance, value, and beauty those here described.

E. A. P.

Field Crops in South Africa.— **Professor H. D. Leppar** and **G. T. Bosman.** Johannesburg: Central News Agency; London: Gordon & Gotch. [1923.] Pp. ix. + 358. 21*s. net.*

This is the first volume of a South African Agricultural Series which is intended to appeal to a wide range of readers—from practical farmers to technical teachers and even advanced students. Though essentially a compilation, it is a thoroughly practical and useful book, perhaps most likely to be of use to the practical farmer in South Africa whose educational opportunities have been somewhat limited; for him, for instance, the slight overemphasis on the value of rotation can be only a wise precaution.

About one-fifth of the book is devoted to general agricultural problems, the second chapter—on climate and soils—being particularly clear and practical, paying special attention to local fluctuations of rainfall and to the relative poverty (especially the deficiency of phosphates) of nearly all South African soils—except on the Karroo, with its widely spread dolerite. The whole of this Part I. is thoroughly good.

The rest of the book is devoted to the "principal" crops of South Africa, treated according to seasonal distribution, but including quite a number of crops that will never be of any importance in South Africa. Part II., which covers about two-fifths of the book, is concerned with the very important "Summer Crops"—from maize and sorghums to cotton and cane-sugar. In each case a short general account of the crop is followed by detailed information and advice about its practical cultivation. One of the inferences that we draw from a study of this is that the very low yield per acre of maize in South Africa is due not only to uncertain or insufficient rainfall, but also to unscientific farming, especially as shown in the use of poor and unsuitable soils.

Rather too much attention seems to be devoted both to lucerne and to the potato. The latter, like maize, is essentially a native of tropical and semi-tropical plateau lands, and so should do well in South Africa, and it does well in parts of the Transvaal and Orange Free State, *e.g.* round Bethal and Thaba 'Nchu; but the normal temperature is too high for optimum growth; and, as for lucerne, surely the large proportion of sour soil and the character of the water-table are reasons for encouraging farmers *not* to try to grow it.

Part III. deals with "Winter Crops," especially wheat; but it is very unlikely

that the impulse given to wheat-growing in South Africa by the War will result in any permanent extension of wheat even in the winter-rain area. Part IV. is miscellaneous, including a chapter on dry farming.

The book is, as said, largely a compilation: the chapter on Tobacco is contributed by Mr. H. W. Taylor; and the treatment of the "brak" (alkaline) soils is practically from Dr. Ross. A good deal of the material is based on experience in countries where the conditions are scarcely parallel with those in South Africa; but what is really pertinent is described in a clear and practical way which must make it very useful to the practical farmer. And the outlook is quite geographical. L. W. L.

AMERICA

Fifty Years on the Old Frontier.— James H. Cook. With an Introduction by **General Charles King, U.S.V.** Yale University Press; London: H. Milford. 1923. 9½ × 6, pp. xix. + 291. *Illustrations.* 18*s.* 6*d. net.*

"Capt. Jim" Cook is one of the few survivors of an interesting and exciting phase of American history. He began life as a cowboy and hunter on the plains of Texas, Kansas, and Nebraska. The experience and the knowledge of the Indians he gained then made him extremely useful as a scout to the American forces in the Indian wars of the 'eighties and later. Finally he settled down as a rancher. During his life, therefore, he has come into contact with all sorts and conditions of men. In his younger days he received, and returned, many hard knocks from Mexicans, ex-Confederate soldiers, refugees from justice, and Indian horse thieves. It was to these types of men that the American cowboy owed his rather lurid reputation, from which the author is careful to vindicate the majority of his comrades, a hard-working and good-natured lot. Later on he formed a close friendship with an Indian chief, Red Cloud. At a time when, through various unfortunate incidents, mistrust of the white man was prevalent among the Indians, the author was able to influence his Indian friend to accept the inevitable—the advance of the whites. The picture of the old Indian stolidly resigned to the disappearance of the buffalo, the breaking down of tribal custom, and the triumph of the white man, is drawn with true understanding and cannot but excite the sympathy of the most hardened believer in the benefits attendant upon the march of civilization.

The Argentine Republic, its Development and Progress.— Pierre Denis. Translated by **J. McCabe.** London: T. Fisher Unwin. 1922. 9 × 6, pp. 296. *Sketch-map and Illustrations.* 21*s. net.*

In 'The Argentine Republic' M. Pierre Denis joins to a marked degree command of detail with a sense of proportion. The writer passed eighteen months in Argentina, and was able to collect local information for the most part not accessible to European writers; but the outbreak of war compelled him to hold over publication until last year. His work is thus complete at 1914 rather than to-day, but its admirable marshalling of facts, and the correct inferences drawn therefrom, make the omission of statistics during the intervening years of minor account.

The author describes his work as "A geographical introduction to the study of the Argentine nation"; with the corollary that "It is colonization, the efforts of human industry to adjust agricultural and pastoral activities to natural conditions, which enables us to assign the limits of the natural regions." Clear thinking and incisive phrasing characterize the author's style throughout, and he is able to practise that most difficult art, viz. accurate generalization.

Thus he describes Tucuman, with its sugar industry, and Mendoza with its wines, as "the two most brilliant satellites of the Pampa," and further we find "While Argentina lives on the Pampa, the Pampa lives on export. It has been developed through the inflow of European immigrants, and Europe pays (for exports) by sending its manufactured products and capital." This is Argentina in a nutshell. The various zones whose interplay has contributed to this result—"one of the great events in the economic history of the nineteenth century"—are then dealt with in detail, the subject being illustrated by sketch-maps of geographical areas, and also of economic zones such as those of cattle, sheep, wheat, alfalfa (lucerne), with their relative densities. It is a pity no general map of the Republic is added to enable the reader to form a bird's-eye view of the whole.

The sheep-rearing districts of Patagonia; the working of the quebracho hardwoods of the Chaco and Santiago del Estero; the mixed forest of Misiones, "land of the hoe," where as in Brazil the average tillage is on fields one-tenth the size of those of the Pampas; a chapter on Roads and Railways and a critical study of the river Paraná, all group themselves naturally round the author's central theme—the study of colonization and production on the Pampa proper. Its limits he defines in the north by the appearance of scrub vegetation, to the west by the Andean foothills, and on the south by the steppe-lands of Patagonia. As a typical example of M. Denis' methods, we may instance a map showing the limit of the fever-breeding tick which in practice separates the Argentine cattle zones. In the first, free of the tick, selective breeding is profitable and unchecked. North of this, inside the tick zone, inferior native cattle are chiefly raised.

The author rightly praises the Argentine hydrographic survey of the Paraná. This department was organized by Mr. Cortell, a Mississippi engineer, whose services the Argentine Government obtained for that end around 1903–5. Whether the U.S.A. Army, to whose engineers control of the Mississippi falls, would agree with M. Denis' statement that "thanks to this work the Paraná is now, no doubt, the best-known river of that size," is at least open to question. The account of the less-known Andean provinces is especially valuable in connection with the different forms of irrigation, around which their population centres, and much of it will be new even to Anglo-Argentines.

Geographically, M. Denis notes the aridity of the Argentine Andes north of Patagonia; "they are as the Atlas Mountains to Scandinavia," and "Mt. Aconcagua is one of the sharpest climatological limits in the world." He especially favours the theory of æolian action in shaping Argentine soil. He will find many authorities, from Colonel George Church downwards, at variance with his conclusions on this point. M. Denis contends that the Pampa soil was in the main laid down as "loess" to great depths over sharply undulating granite bedrock by the action of wind and not by water, but is careful to note the diversity of opinion on the subject. He is on safer ground in suggesting that the "loess" may have been first laid down as a result of aerial erosion, and later shaped by water action.

The early routes across the Andes, by which the outlying provinces maintained their trade with Chile, Bolivia, and even Peru, and the absorption of all such outward trade currents by the growth of Buenos Aires, now counting a population of 2,000,000, are lucidly set out. In regard to railway construction, while stress is laid on the part played by the Paraná ports in short-circuiting traffic to the nearest waterway, fuller mention might have been made of Bahia

Blanca, whose growth has been one of the outstanding factors in railway expansion south of Buenos Aires and in Patagonia. The decade which has elapsed since the author's stay in the country has also seen a considerable change in the situation both as regards railway and motor transport, an appreciation of which we therefore miss.

A small matter for criticism is the occasional incorrect rendering of Spanish words. Thus, "angada" should read "changada" (log raft); "garrapate," "garrapata" (tick); "rustrillada," "rastrillada" (cattle or horse track). Such details, however, do not detract from the real value of the book. If M. Denis' plans could have been carried out, it would doubtless have been still better; as it stands, it will be some time before it is improved upon. Had its publication been possible thirty years ago, many economic errors, such as those which planted Argentine's chief sugar industry at Tucuman, within the frost zone and at the extreme southern limit of sugar-cane, might have been averted.

W. S. B.

HUMAN AND HISTORICAL GEOGRAPHY

Fossil Men—Elements of Human Palæontology.— Marcellin Boule. Translated by **J. E.** and **J. Ritchie.** Edinburgh: Oliver & Boyd. 1923. 10 × 6½, pp. xxviii. + 504. *Illustrations.* 36*s. net.*

Prof. Boule's admirable work on Ancient Man was so quickly appreciated that before long the first edition was out of print. A second edition soon followed. Before it appeared, however, a translation had been made by Miss and Mr. Ritchie. This disadvantage has been got over by adding an appendix containing the new matter in the second edition. The translation has been well done, and all the illustrations of the second edition are included. Students unacquainted with French will thus be able to benefit from M. Boule's book, though at a much enhanced price, for the French edition can be bought for less than a third of the price charged for the translation.

The lucidity, moderation, restraint, sense of proportion and sane criticism that characterize this treatise cannot be overpraised. All who are acquainted with the numerous and varied discoveries made since the human remains from the Neanderthal cave were brought to light, and the many speculations and differences of opinion regarding them, will be struck with the well-ordered manner in which the essentials of this vast amount of material are arranged in the contents, and the way in which the salient facts are clearly presented, freed from the clouds of theory and personal opinion so liable to obscure the subject, and to confuse and tantalize the student.

Prefaced with a historical survey of the earlier discoveries, a chapter is devoted to the geological aspect of the subject in which the thorny topic of chronology is dealt with. A list is given of the different estimates of the duration of the Quaternary Age, made by as many different authorities. The uninitiated, when he finds that they vary from ten thousand to a million and a half years, can hardly help exclaiming in despair, Where is the truth? After treating of Living Primates and Fossil Monkeys, a chapter is given to what might be described as the transition stage, for it contains an account of *Pithecanthropus*, the Ape Man. The discovery and nature of the remains are fully described and their bearing on the evolution of man discussed. The ground being thus cleared, the actual remains of Fossil Man are dealt with *seriatim*. The problem of Tertiary Man first engages attention, involving the much-discussed Eoliths. Here the author appears at his best. As a piece of scientific criticism fairly and impartially handled, it could hardly be improved upon.

His conclusion is, that though he does not doubt the existence of Tertiary Man it is not proved by the evidence hitherto adduced in its support. Men of the Chellean Age have first to be considered, and here the Heidelberg, Ehringsdorf, and Piltdown discoveries alone emerge free from uncertainty. The two last are regarded as later than the first, being referred to the Acheulean period. Neanderthal Man, the study of which Prof. Boule has made peculiarly his own, claims a long chapter, and receives a full exposition. The remains of the Reindeer Age suggest the existence of three races, the Grinaldi, Cro-Magnon, and Chanelade. If the first is rightly included in this Age it must date from the very beginning of it. Although the evidences of the last are meagre the author appears to be convinced of its reality, and is evidently inclined to favour the view that it is connected with the existing Eskimo. The similarity in their artistic powers of the Cave Men and Eskimo was urged in favour of similar views long ago. In this connection an illuminating account of the human figure as represented in Palæolithic art is presented and illustrated, including the remarkable ivory statuette discovered by M. and Mdme. Saint Perier at Lespuge as recently as 1922. The author's view is of course absolutely opposed to that of high authorities in America, including Boas, who believe that the Eskimo are derived from native inland American tribes; and it may be recalled that in this belief they are following that great pioneer, Dr. Rink. An interesting fact regarding these three races is that they show affinities with the three great divisions of mankind, Negroes, Whites, and Yellows. But the author in concluding the discussion pulls himself up, and with characteristic care and prudence guards himself against being carried away by fascinating theories, for he says, "We cannot hide from ourselves the fact that these conclusions are still vague and uncertain. It will be necessary to submit them to the test of new excavations, and these must be undertaken with an absolutely clear understanding of the great anthropological problems to be solved, and not with the sole aim of making collections of archæological objects."

Having disposed of Fossil Man the problem of the transition from Ancient to Living Man is attacked. Its difficulties are fully recognized. After referring to the three racial types of Modern Europe, the Nordic, Alpine, and Mediterranean, the comparative chronology of Prehistoric and Historic times is considered, and illustrated with a table. The transition from the Palæolithic to the Neolithic Age and the Azilian race are then touched upon, and finally the Neolithic races and their relation to the three existing European types discussed.

The penultimate chapter is the longest in the book, and one of the most useful, for it brings together all the reliable information hitherto accumulated regarding Fossil Man outside Europe. Discoveries in Asia, Australia, Africa, and the Americas are critically and impartially examined, and their true value appraised. It includes the latest finds up to date, the Broken Hill skull being fully described and illustrated. Ameghino's sensational contentions regarding the remains found in South America are rejected. The last chapter of General Conclusions contains an interesting account of the different views regarding the genealogy of man in relation to the other Primates, illustrated with a very useful diagram.

This brief account of a most interesting work may fitly conclude with a remark of the author which expresses his faith. "The last word," he says, "must be with Palæontology. It cannot be too often repeated that the origin of man is a problem the solution of which can only be looked for from Palæontology."

E. A. P.

The Sea Traders.— **Archibald Hurd.** London: Cassell & Co. 1922. 8 × 5½, pp. 224. *7s. 6d. net.*

The historian, says Mr. Hurd, offers no solution to the riddle "that the little island of Britain . . . should have become at last the pivot of an empire embracing nearly one-quarter of the land surface of the Earth." The historian, he argues, has generally been a landsman, and so has missed the secret, which is sea-power. We can hardly believe that Mr. Hurd has not read such well-known books as Seeley's 'Expansion of England,' or Lyall's 'Rise of British Dominion in India,' to name but two of the many histories of British expansion which would refute his criticism. Whatever may have been the case forty years ago, the student of to-day is not likely to ignore the importance of sea-power in the long story of exploration, colonization, trade and conquest, which is so important a part of Great Britain's modern history. He is as a rule far more ignorant of the character of the Empire than of the causes of its growth. But if Mr. Hurd's secret is found to be an old one, his book is none the less very readable, and tells a familiar story in an easy, pleasant, and original way. He traces the growth of British maritime trade from the enterprises of the merchant seamen of Bristol to those of the great shipping companies of to-day, expanding his treatment with the expansion of his subject, bringing out its wealth of colour and variety of scene, and with sympathy, insight, and deft touch, giving life to the successive phases and personalities of the long story. He very properly lays stress on the important part which individual enterprise has played in the expansion of British power and wealth, and illustrates it with a telling reference to the part played by the tramp steamers in the late war. "It was the obscure private that, in the long run, won the war on land; and at sea it was much the same. It was not the luxurious passenger liner, steaming at high speed, it was not even the big cargo liner; it was, above all, the tramp, buffeting her patient way over the world's seas, that was the chief maritime instrument of victory, apart from the Grand Fleet. The tramp was the lineal successor of those earlier individual vessels owned by single enterprising sea traders who laid the foundations of our prosperity. . . ." It is an interesting book which most boys and other people too will enjoy to read. There are a few historical slips, as on p. 58, where Mr. Hurd writes of Philip IV. of Spain, when he means Philip II., and where he appears to think that Queen Elizabeth ruled the whole of the British Isles. E. A. B.

THE MONTHLY RECORD

EUROPE

The Livradois, a French "pays."

ONE of the admirable regional studies, of which we have had so many from French geographers, is given by MM. Gachon and Richard in the *Annales de Géographie* for 15 January 1924. Its subject, the Livradois, is a well-marked natural unit lying partly in the Puy-de-Dôme, partly in the Haute Loire, between the Allier and its tributary the Dore. The district is a fragment of the old Hercynian peneplain, formed almost entirely of crystalline rocks and sharply divided by a series of faults in the north, east, and west from the basins which surround it, while on the south it passes more gradually into the volcanic region of the Velay. It may be broadly divided into three concentric zones—a central peneplain, an intermediate belt, and an outer fringe of gorges. The

first has a mean altitude of 950 to 1100 metres, and its surface consists of gentle swellings (known as *sucs*), separated by broad marshy depressions, through which the water percolates slowly. The slopes consist of a friable black soil, too light for successful cultivation. The intermediate zone has its greatest extension in the north, north-west, and west. Here fern-covered plateaux and ridges are separated by wide basins, the granite sometimes coming to the surface of the former in great masses known as *gores*. The fall is sufficient to admit of well-drained pastures, and the ochreous soil of the slopes, though light, is adapted for cultivation. In the outer zone a series of steep-sided gorges cut up the old surface into isolated tongues, and the signs of human occupation are scanty. With its considerable altitude and exposure to all winds, the Livradois has a fairly rigorous climate, snow lying long in winter. The rainfall is considerable, but where the slope is rapid, the radial drainage quickly carries away the water, and the surface becomes burnt up in summer. In the central parts, where the slope is less, the water is better stored in the spongy soil of the grass-lands, or the humus of the woods.

The natural features above described have kept the district more or less isolated, and during the eighteenth and first half of the nineteenth century the rural economy changed little. The land belonged to the local bourgeois, who let it out to tenant-farmers. Cultivation was primitive, and the live stock consisted chiefly of sheep. The people produced a little of everything for their own needs, but agriculture was supplemented by small rural industries, especially lace-making and (in the north) the weaving of rough sorts of cloth, and the goods went considerable distances—to Germany, England, Spain, and Piedmont. A change set in about 1850, due to improved means of communication, decline in population, the disappearance of the rural industry, and the creation of small holdings. The making of better roads within the district and of railways round its margin brought it more into relation with the outside world. The land had become over-peopled, and emigration assumed considerable proportions. At first temporary (many peasants going as sawyers during winter to the four corners of France) it eventually became permanent, many of the young men becoming "chiffonniers" (travelling mercers) and eventually settling down at a distance, while many found their way to Paris and other large towns as labourers or workers in various trades. Local industry has not been revived to any extent (though some lace is still made), but there has been a decided improvement in agricultural methods, so that, though less ground has been cultivated, the yield has improved, and a considerable export of dairy produce, and still more of calves for slaughter, has been developed. Forestry too has shown an advance, and on the whole the lot of the peasant has distinctly improved.

The Rhine Delta in the Lake of Constance.

The growth of the deltas of the Rhine and the Bregenzer Ach in Lake Constance during the years 1911–21 is fully described in a pamphlet, 'Rheindelta im Bodensee, 1921,' by W. Stumpf, published by the Swiss "Amt für Wasserwirtschaft," Berne, 1923. The results embodied therein were obtained by a survey made in the spring of 1921: the results of a similar survey in 1911 permit detailed comparison, thus furnishing a basis for the estimation of the rate of growth. The survey of 1911 was confined to the area south of a line from Rohrspitze to the mouth of the Bregenzer Ach, that is, 2 km. off the mouth of the Rhine, as it was thought that beyond this sedimentary deposits would be inappreciable. In 1921, however, the limit was extended

to 5 km. from the river mouth, thereby increasing the area examined from 7 to 12 million sq. metres. For the former area (the "old area") the procedure was that followed in 1911. The number of soundings made here was 6380, or 911 to the sq. km.; and 60 profiles or sections of the delta were prepared. In the "new area," the number of soundings was 2315, or 454 per sq. km., few observations being taken on the "plateaux" off Rohrspitze and Lindau, while the weather was unfavourable further out. For this area, twenty-four profiles were prepared.

The visible changes in the delta include the growth of the island in the left arm of the Rhine and the formation of a new sandbank off Hard, on the opposite side. The underwater changes can be estimated by a comparison of the figures for 1911 and 1921. During these years the area of the delta has increased 244,000 sq. metres, to which the new island contributes 216,000 sq. metres. The total increase in volume of the delta, within the old area, is estimated at approximately 23 million cubic metres, an average annual increase of 2½ million cubic metres. The figures for the new area are less certain: they swell the annual figure to 3,172,000 cubic metres. On the basis of the relative areas of the river basins, the Rhine is credited with bringing down 2,790,000 cubic metres out of this total. This figure is equivalent to an annual removal of 0·46 mm. from the whole surface of the Rhine basin above Lake Constance. As a result of these deposits, the average depth of the lake in the "old region," which in 1911 was 17·2 metres, is to-day only 14·4 metres. The complete results of the survey are shown by contoured charts and sections.

ASIA

Motor Transport in Persia.

We have received from the Department of Overseas Trade details of a motor service between Tehran and Resht. This has been established by M. Marobbic, the Italian agent for the Fiat Motor Manufacturing Company in Tehran. The journey of some 200 miles is done by Fiat lorries, and has been maintained successfully even in winter. First-class passengers are provided with benches, second-class sit on the freight at the back. M. Marobbic receives a subsidy from the Ministry of Posts for transporting the mails between Tehran and Resht. He also runs an irregular service of lorries for pilgrims to Khanikin. This route is closed during the winter.

A New Railway in Manchuria.

Through the courtesy of the same Department we have received a memorandum from H.M. Consul at Dairen, South Manchuria, on the Chientao Light Railway. The Chientao district lies on the borders of Kirin Province and Korea, in the valley of the Tumen river. Tienposhan is reported to be rich in silver and copper, while its forests are also valuable. In order to develop this region, the construction of a light railway from Tifang has been commenced. Tifang is on the Chinese bank of the Tumen, opposite Sanpo, about 20 miles north of Hoiryeng in Korea, which is already connected by railway through Kwainei with Seishin and Kyojo on the sea-coast. The first section of the new line, from Tifang to Lungching, 36 miles to the north-west, is now open. Lungching is reported to be an important and growing market. Work has been started on the next section of 26 miles between Lungching and Laotuko, the centre of a coal district. The final section of 10 miles to Tienposhan will be built as soon as possible. On the completed section two trains daily are running each way. The average daily freight is 100 tons, and the number of passengers 170.

AFRICA

The Climate of Khartoum.

The Egyptian Ministry of Works has published a valuable compilation by Mr. L. J. Sutton about the climate of this important city, constituting Physical Department Paper No. 9 (1923). Situated about lat. 15° N. and 1000 feet above sea-level, on the peninsula between the Blue and White Niles on the southern margin of the Nubian desert, Khartoum is the very type of a really hot climate, and the thermometric data are most striking. Thus the mean annual temperature is 85° F., varying between 95° in June and 72·5° in January, as based on the twenty years 1901–1921. For six months in the year the mean daily maximum exceeds 100°, being highest, 107°, in June, and lowest, 92°, in January, whilst the mean minimum is 79° in June, and 58° in January. The absolute maximum for the period was 117° in July 1901, and the absolute minimum 43° in January 1903. The city lies sufficiently far south to come within the northern margin of the Sudan rains, experiencing a short rainy season between July and September, when barometric pressure becomes low over the Red Sea, and the usual northerly winds give place to south-westerly. The average annual fall, however, is scanty, being but 5·9 inches, and the yearly amount fluctuates within wide limits. Much of the rain of the "rainy" season comes in thunderstorms, which latter are often associated with violent vertical sandstorms known as "haboobs," which originate in the protracted heating of extensive desert tracts.

Of fundamental importance in tropical countries is the record of the wet-bulb thermometer, and it is satisfactory to find special prominence given to the discussion of humidity in its several aspects. As the temperature of the air approaches that of the blood the vapour tension normally becomes so high that, with a high wet-bulb, cooling of the body by evaporation is brought very low just when physiologically it ought to be most vigorous. The unhealthiness of the Gold Coast (with a wet-bulb close on 80° F. throughout the year) is due to a high humidity near the point of saturation. In the dry heat of Khartoum it is only during the rainy season, July to September, that the mean wet-bulb reading exceeds what is generally regarded as the limit of comfort, namely 70° F., and even this is rather an index of a very high dry bulb (air temperature) than of high humidity. In Khartoum the danger is rather the incapacity of the sweating mechanism of the body to cope with excessive evaporation, and the most trying period is during the hot months of May and June before the rains come, and the humidity is down between 20 and 30 per cent. An instructive comparison is given of readings with the kata-thermometer (invented by Dr. Leonard Hill), showing the relative cooling power of the atmosphere exerted on both a dry and moist surface at the temperature of the human body, as between Khartoum, Cairo, and London. Whilst the cooling power on the average of the year is, of course, much greater in London than in Cairo, and still more than in Khartoum, in London during July and August (when the temperature and vapour tension reach their maximum) the cooling power is rather less than at Cairo in mid-winter (when they reach their minimum), but still distinctly greater than at Khartoum at the most favourable season, January. In the climate of tropical deserts the question of absolute humidity (as expressed by dew-point or vapour tension) assumes special interest. At Khartoum, although the vapour tension is very low in relation to the temperature, it is actually higher than in England, the mean annual figure being 8·4 mm., comparing with 8·8 at Cairo, and 7·3 at Kew. The vapour tension at Khartoum, however, is very variable, and occasionally drops nearly to zero, which it never does in England.

AMERICA

Northern Canada.

We have received from Inspector La Nauze, of the Royal Canadian Mounted Police, two pamphlets issued by the North-West Territories and Yukon Branch of the Department of the Interior, which give some interesting information on present conditions in Northern Canada. The first, 'Canada's Arctic Islands,' by J. D. Craig, describes the voyage of the C.G.S. *Arctic* from Quebec to Ellesmere Island in 1922, for the purpose of establishing police posts to protect the natives and the game, and of making topographic and geological surveys. A representative of the Air Board also accompanied the expedition to examine the question of aerial transport in the Arctic. Leaving Quebec on July 18, the ship was delayed for a time in Davis Straits and Baffin Bay by the presence of "middle ice." The ice also prevented the ship from entering Ponds Inlet, Bylot Island, where a police post was to be erected. On August 20 Ellesmere Island was sighted. The intention was to establish a police post in Fram Fjord, but again the ice prevented them from entering. Accordingly the following day, a small inlet just within Smith Island, named Craig harbour, was chosen for the site of the post. Materials and supplies for two years were landed for the inspector and six men, who, with an Eskimo family, constituted the post. For fear of being frozen in, the *Arctic* sailed south before the buildings had been completed. On the return, Dundas harbour, on the east coast of North Devon Island, was examined with a view to the future erection of a headquarters post there, and found suitable. Arriving off Ponds Inlet, the ice was found to be more broken up, and after some difficulty the settlement, consisting mainly of a Hudson Bay Company store, was reached. Materials for the requirements of a police post, consisting of four men, were then landed. Godhavn, Disko Island, was visited on the way to Quebec. At each post, Major R. A. Logan, the aerial expert, selected and surveyed sites for aerodromes. In his report he states that the months May, June, July, and part of August are generally suitable for flying. With the twenty-four hours of daylight, the opportunities for exploration, surveying and patrolling by aeroplane would be great.

The second pamphlet, 'Local Conditions in the Mackenzie District, 1922,' by J. F. Morgan, describes the route from Edmonton, *viâ* the Slave and Mackenzie rivers, to Aklavik, on the Mackenzie delta, with notes on the country traversed. The railway ends at McMurray on the Athabaska River. Thence the journey is made by river during the summer months, broken at Fitzgerald owing to the Smith rapids. Further delay may be caused by rough weather in the Great Slave Lake. In winter, of course, the sole means of communication is by dog-sledge. Most of the settlements passed are fur-trading posts; at the larger, such as Fort Smith and Providence, there are missions, hospitals, and schools. The chief occupation is the fur trade. In the neighbourhood of the Great Slave Lake, gold-bearing quartz and lead-zinc ores have been located. Prospecting for placer gold along the Mackenzie River has met with some success, and for 100 miles below Norman the country on both sides of the river is under lease for petroleum and natural gas. Up to 60° N. hardy garden products can be grown, as well as oats and wheat. By the enterprise of the missions, several cattle farms have been established. The population of the whole Mackenzie District is very sparse: the whites number 709, the Indians 3854; and there is also a nomadic Indian and Eskimo population of about 1000.

Port Hood Harbour, Cape Breton Island.

The causes of the deterioration of Port Hood as a harbour are set forth by Mr. D. S. McIntosh in a paper printed in the *Transactions of the Nova Scotian Institute of Science*, vol. **15**, pt. 2. The present town of Port Hood on the western side of Cape Breton Island is faced by Smith Island, about a mile from the shore. At one period this latter island was connected with the mainland. The general land subsidence in this region, and the flooding of a river valley, separated it from the land, except for a narrow spit in the north where the rocks were more resistant. On Des Barres' charts of the western coasts of Cape Breton, dated 1781, Port Hood Harbour is shown to consist of the present Smith Island linked to the shore by sandhills, with cliffs of red earth at either end of the neck. This neck of land is shown, as late as 1826, on land grants in the Crown Lands Office, Halifax. Port Hood then was a well-protected harbour, open only to the south-west, from which direction danger from a storm was not great. Its channel had a depth of 6 fathoms at the shallowest, while the harbour, with no bars, had an average depth of 4–6 fathoms. At this time it was much frequented by fishing fleets. The homes of the fishermen lay round the harbour, but the best local fishing lay to the north. Consequently, to shorten the trip, the fishermen cut a channel through the northern neck at its lowest part. No measures were taken to protect it. By the action of the sea the neck was gradually destroyed, and the present channel is about three-quarters of a mile wide, with a depth of $1\frac{1}{2}$ fathoms. The harbour is now exposed to the north and north-easterly winds, the coast around Port Hood itself is being eroded, and some silting-up has occurred in the harbour. For the moment the island still serves as a protection to the anchorage, but even this is threatened, as the north-east projection of the island is in danger of being broken away by the sea. Between 1903 and 1912 attempts were made to block up the northern channel again, and 135,000 dollars were spent. The latest development emphasizes the need for such an undertaking; its cost is now estimated at 500,000 dollars.

GENERAL

Régime of International Waterways.

The measures for the extension of freedom of navgation on international rivers, adopted by the Barcelona Convention of 1921, have been published lately (Treaty Ser. No. 28, 1923. 'Convention and Statute on the *régime* of navigable waterways of international concern, together with additional Protocol to the Convention. London, 1923'). The Convention applies to those waterways, naturally navigable to and from the sea, which separate or traverse different states, and waterways expressly placed under the *régime* of the General Convention, but not to rivers which merely delimit or traverse small enclaves alone. Navigable waterways for which there are International Commissions upon which non-riparian states are represented are regarded as forming a special category. Subject to the exceptions noted later, each Contracting State shall accord free exercise of navigation to vessels of the other Contracting States, on a footing of perfect equality. But under Article 5 a riparian state has the right of reserving to its own flag the transport of passengers and goods between two ports under its own sovereignty. Where greater freedom already exists, this is not to be diminished. Nor does this Statute apply to war vessels or vessels exercising any kind of public authority (Article 17). Each Contracting State maintains its existing right of enacting measures for policing the territory and for customs, public health, etc., without

discrimination. No kinds of dues are to be levied except in return for services rendered. Subject to Articles 5 and 17, the nationals and property of each Contracting State shall enjoy in every port situated upon a navigable waterway of international concern treatment equal to that accorded to nationals of the state in which the port is. Each state is bound, within defined limits, to refrain from interfering with the navigability of an international river, and to take measures as rapidly as possible to remove dangers to navigation. Failing settlement by agreement or arbitration, disputes arising out of this Statute are to be submitted to the Permanent Court of International Justice. By September 4, 1923, ratifications of their signatures to the Convention had been deposited by the British Empire (excluding Canada, South Africa, and Australia), India, Albania, Bulgaria, Denmark, Finland, Italy, and Norway.

Geography in a British School Book.

We have received a letter from the distinguished President of the Royal Danish Geographical Society, Admiral Wandel, calling attention to the description of Denmark given on page 154 of 'A New Geography,' by "J. M. D. Meiklejohn. Professor of the Theory, History, and Practice of Education in the University of St. Andrews, etc. Forty-Third Edition, thoroughly revised, Meiklejohn & Son, Ltd., 1924." The chapter on Denmark begins: "Denmark, 'Keeper of the Baltic Portals,' is yet one of the smallest, weakest, poorest, and least populous of all the states of Europe. It has about half the population of Greece, which is a growing power, while Denmark has for a long time been dwindling."

The Danish Geographical Society very naturally take exception to this remarkable account of their country, and asked us to bring the passage to the attention of the author and publishers. Messrs. Meiklejohn immediately replied that they much regretted that the information given about Denmark is so contrary to the facts. They sent also extracts from a letter from the Editor of the book, to this effect: "I can only reiterate the expression of regret, which I understand you have already sent to the Secretary of the Royal Geographical Society, that any occasion for it should have arisen. The passage in question was written many years ago by the late Prof. J. M. D. Meiklejohn, who was all his life a warm friend of Denmark, and who, in the struggle of 1863 against Prussia and Austria, enthusiastically supported the Danish cause in his letters, as a war-correspondent, from Copenhagen to the *Manchester Examiner and Times*. The passage is doubtless inaccurate, but could not possibly have been meant by Prof. Meiklejohn to be insulting, and I feel sure that it would have given him real pain to have it supposed that he had deliberately written anything insulting about Denmark or the Danes, for whom he entertained a strong affection."

These expressions of regret have been communicated to the Royal Danish Geographical Society, but it may be useful to call attention to the incident. A school book which is in its forty-third edition must have a large sale. The book appears under the name of a gentleman who is long since dead, and there is no information whatever as to who is responsible for the alleged revision. A rapid glance at the book shows that the above inaccuracy is by no means the only one. "The highest peak of the Himalaya is Gaurisankar (or Mount Everest)," and K_2 is not mentioned. "The area of Egypt is 12,000 square miles." "All the great international commercial routes of the world now converge upon the Suez Canal," and so on. It is certainly deplorable that a book of this character should be used in British schools at the present

day, and we may hope that the protest of the Danish Geographical Society will do much good in calling the attention of Fellows of our Society and educational authorities to the shortcomings of a geography which is not worthy of use in its present condition.

OBITUARY

Captain Thomas Henry Tizard, C.B., F.R.S., R.N.

By the death of Captain Tizard on February 17 at the age of 85, the Geographical Society loses one of its Fellows distinguished as an oceanographer, hydrographic surveyor, and navigator. His service in the Navy began as Master's Assistant seventy years ago, on board H.M.S. *Dragon* during the Russian war 1854–56, and on promotion to Second Master he joined in 1860 H.M. surveying vessel *Rifleman*. In that ship Tizard acquired valuable experience which he turned to good account in later years. The survey of the reefs and shoals abounding in the South China Sea necessitated the use of the schooner *Saracen* to act as a tender to the *Rifleman*, of which Tizard was given the command on attaining the rank of Master in June 1864. He was invalided home three years later suffering severely from dysentery.

Tizard's seven years' continuous service in China was followed by his appointment as Navigating Lieutenant and Senior Assistant Surveyor of H.M.S. *Newport*, under the command of Captain (later Sir George) Nares. At the official opening of the Suez Canal in 1869, the *Newport* led the long procession of ships. The laying of a submarine cable between Malta and Alexandria was carried out under Tizard's direction, and the following three years were occupied in the survey of the Gulf of Suez rendered necessary by the opening of the new canal route through the Red Sea. In the course of this survey Tizard's ability and resourcefulness as a surveyor were conspicuous, and it was at that time he brought out the "Table of Chords" that has proved such a boon to his brother surveyors. The officers and ship's company of the *Newport* being turned over to a larger vessel, H.M.S. *Shearwater*, the investigation of the surface and undercurrents in the Straits of Gibraltar was undertaken, and the vexed question of the movement of those waters set at rest. Towards the end of 1872, the appointment of Captain Nares to command the famous *Challenger* Expedition led to Tizard's transference to the *Challenger*. An excellent surveyor and navigator, a man of strong personality, and a master hand at handling a ship, a better selection could not have been made. The *Challenger* Expedition for the investigation of the physical conditions of the ocean and the distribution of marine life marked an epoch in oceanography and gave to Tizard a rare opportunity, of which he did not fail to take the fullest advantage, to promote the success of the expedition.

As Navigating Officer and Chief Assistant Surveyor his duties involved the closest associations with the leader of the expedition and the chief of the scientific staff in decisions bearing on the carrying out of the objects of the expedition. The ordinary duty of a navigating officer was only a small proportion of Tizard's activities. From the outset he closely identified himself with every undertaking with which the expedition was concerned. As time went on the influence he exerted was increasingly apparent, and on the change

of captains which took place when Captain Nares left the ship to take command of the Arctic Expedition in 1875, Tizard's services to the *Challenger* Expedition had become so indispensable that no question of his being spared for the Arctic could arise. The expedition would never have been the success that it was but for the ability and cheeriness of Tizard, who had been promoted to Staff Commander in 1874. Eventually the *Challenger* paid off in 1876, and for the ensuing three years he was employed at the Admiralty in association with the late Sir John Murray in writing the narrative of the voyage with its oceanographical and hydrographical results. Little at that time being known about the meteorology of Japan, Tizard made a valuable contribution towards it by analysing and tabulating observations made at the lighthouses and lightships on the Japanese coast, and from the mean monthly results constructing diagrams showing the yearly curves. Resuming active surveying duties afloat in 1879, Staff-Commander Tizard served in the *Porcupine* on the survey of the coast of England, and took charge of the survey the following year in command of the hired vessel *Knight-Errant*. He commissioned a new vessel, H.M.S. *Triton*, in 1882, for surveying work on the east coast of England, and during the nine years that he held the command he wrote many papers of scientific value and interest. One of the earliest and most important of these—on deep-sea explorations in Færoe Channel in 1882—was read at the Royal Society and the Royal Society of Edinburgh. In 1890 Tizard published in *Nature* an article on "The Thames Estuary." This article deals very fully with questions affecting that estuary, and is one of great permanent value to all those whose duty it is to maintain the channels of the estuary of a river of such national importance as the Thames.

Promoted to Staff-Captain in February 1889, Tizard was appointed Assistant-Hydrographer of the Navy in 1891, and was elected Fellow of the Royal Society the same year. He served on the Council from 1902 to 1904. Being placed on the retired list with the rank of Captain in December 1896, he continued to serve at the Admiralty, and in June 1899 the honour of a civil C.B. was conferred on him.

As a member of the Joint Committee of the Royal Society and Royal Geographical Society dealing with the equipment and instruction for the conduct of the National Antarctic Expedition of 1901–04, Captain Tizard's practical knowledge of the conditions of Antarctic Navigation gained during the voyage of the *Challenger*, and his wide experience on all matters connected with scientific expeditions, rendered him a particularly useful member of the Committee.

In 1902 Captain Tizard proceeded to Gibraltar to report on the feasibility of making an alternative harbour on the eastern side of the Rock of Gibraltar, for which he received the thanks of the Board of Admiralty. He continued to serve as Assistant Hydrographer until the autumn of 1907, when he was awarded a special pension in recognition of his valuable public services.

After his retirement he wrote and edited various Admiralty publications, among which 'Tides and Tidal Streams of the British Isles' was perhaps the most important; this work he rewrote entirely. The last, and not the least, public service performed by Tizard was to report and prepare plans to assist the Admiralty Committee, under the chairmanship of Admiral Sir Cyprian Bridge in 1912, to arrive at a conclusion relative to the tactics employed by Nelson at Trafalgar. The investigation and co-ordination of all records from ships' logs and other sources enabled Tizard to prepare a

track chart and three plans, which the committee states in its report to be "the first and only plans representing any phase of the Battle of Trafalgar which have been exactly drawn to scale, and in which the positions assigned to particular ships in the British Fleet have been settled in accordance with the evidence contained in the logs and journals." Tizard had a power of great concentration of thought and application. His geographical knowledge was world-wide. He married in 1881 Mary Elizabeth, daughter of W. H. Churchward, C.E., who survives him. A. M. F.

Prof. F. Ōmori.

[At the request of one who knew him well, we print the following further appreciation of the late Prof. Omori, of whom a brief obituary notice was given in the March number of the *Journal*.—ED. *G.J.*]

The death of Prof. Ōmori at a comparatively early age was not only "a misfortune to seismology," but a great loss to his many friends, among whom the present writer had the good fortune to be numbered. We met, appropriately enough, at the foot of Japan's loftiest active volcano, Yakedake, in the Northern Japanese Alps, and the time spent together there, at Kamikōchi, now becoming the Zermatt of that region, revealed a character of charming modesty in combination with unique scientific attainment.

No one individual, probably, ever had so wide and continuous a personal experience of the actual results of volcanic and seismic phenomena, for the most destructive earthquakes and several of the most violent eruptions of modern times all occurred in his own country during the years in which he was actively engaged in the study and observation of such disturbances. In the terrifying shocks of the "Gifu" earthquake of 1891, and the "Tokyo" earthquake of 1923, and in the no less startling, though less destructive eruptions of Bandai-San (1888), Sakurajima (1914), and Yakedake (1915), in addition to numerous other instances of both kinds of disturbances during the intervening years, Ōmori had material for such observation and study as has never fallen to the lot of any other seismologist. Unlike many earthquake students elsewhere, he was able to turn the knowledge thus acquired to useful ends, and it was in this fact that he used to express his chief satisfaction. Like most Japanese of ability, he was always eager to apply the results of his observations to the practical advantage of the people living in areas most affected by eruption and earthquake. Two signal instances of this fact are worthy of mention here. In 1910 Usu-dake, a volcano 2300 feet in height (near Muroran, in Hokkaidō, the northern great island) was in eruption, forming no fewer than forty-five small craters on the mountain itself and producing a new mountain 600 feet high above the surface of the adjacent Lake Toya. The local police authorities, however, had in good time heeded the warnings of Prof. Ōmori and had evacuated the inhabitants of the threatened area, and not a single life was lost.

A still more remarkable case was that of the volcano of Sakurajima, at the remotest opposite end of Japan proper, off the city of Kagoshima in the south of Kyūshū. Here, thanks to Ōmori's foresight and advice, nearly 100,000 people were removed to a safe distance from the island of Sakurajima and the city of Kagoshima, and the actual loss of life was under a score.

I well remember the satisfaction with which he used to speak of the practical benefits of his predictions, in the case of the Yakedake eruptions, to the farmers cultivating the mulberry plantations so all-important to the

sericulture of the adjoining provinces of Hida and Shinshu. From Japanese sources the last news of him was that of the intense and solicitous eagerness with which he strove, during the last weeks of his life, to induce his pupils and colleagues to spare no effort in observing and in utilizing the knowledge gained from the late earthquake to ends of a useful and practical character.

WALTER WESTON.

CORRESPONDENCE

Ice Conditions round Wrangel Island.

UPON my return from the Arctic this winter my attention was called to an unsigned article in the *Geographical Journal* for December 1923, "Wrangel Island." The statement is made in this article: "Owing to difficulties experienced by Mr. Stefansson in raising funds, the relief ship did not sail until the end of August 1922, a month after the close of favourable navigation, and failed to reach the island." I have noted the same statement made by Mr. Stefansson over his own signature in *The Times*, 9 October 1923, and in other publications.

I was master and part-owner of the gasoline schooner *Teddy Bear* that made the unsuccessful attempt to reach Wrangel Island in the summer of 1922, leaving Nome, Alaska, 20 August 1922. I disagree with Mr. Stefansson when he states that I sailed a month past the most favourable sailing time. I speak from twenty-four years' experience in Arctic navigation. In my judgment and the judgment of every Arctic navigator to whom I have referred the question, the most favourable time for sailing in the waters around Wrangel Island in an ordinary season is the month of September. In a year such as 1922, when ice conditions were not so favourable as in other years, a later sailing date than August 20 would have been still better. It has been proved by the diary of Knight, who perished on Wrangel Island, and the statements of Ada Blackjack, the Eskimo woman cook, who survived, that the only possible time for a ship to reach Wrangel Island in 1922 would have been in October. According to this a later sailing date for leaving Nome would have been still better for me.

I further disagree with the impression which Mr. Stefansson tries to give when he states (*loc. cit.*) that the Wrangel Island season of navigation is never more than four months, and in bad seasons less than two months. In the most favourable years that have ever been known the Wrangel Island season of navigation is probably two months; in ordinary years it is difficult to reach Wrangel Island at any time; in years when bad ice conditions prevail—and this is often—it is impossible to reach Wrangel Island with a ship. In such a year as 1920, I know from my own experience in those waters that year that no ship could have reached the island. 1921 was a remarkably favourable year. It is possible that a ship could have reached the island *late* in the season of 1922. The year 1923 was another exceptional year. On the Alaskan side the natives report there has not been such an open season in the last twenty years.

Mr. Stefansson says further that the *Donaldson* left Nome in 1923, "the ideal time—the first week in August." From the published accounts of Mr. Harold Noice, commander of the relief ship of 1923, and from private conversations which I have had with him, there is no doubt that the *Donaldson*

had very great difficulty in reaching Wrangel Island even in 1923, though Mr. Stefansson states that it reached the island "without difficulty." I was engaged by the owner of the *Donaldson* in Nome in October to make an examination and report as to the seaworthiness of the ship after her return from Wrangel Island. My observations confirm Mr. Noice's statements. The *Donaldson's* sheathing was carried off by the ice; the stem-posts were chewed up so that the ends of the planking were exposed and the water was running into the forward compartment. Had it not been for her watertight bulkhead the ship would have sunk before reaching Wrangel Island. This convinced me again that a later sailing date than August 1 for such a remarkably open year even as 1923 would have been advisable.

JOSEPH F. BERNARD.

Loyola College, Montreal, P. Quebec, Canada,
7 March 1924.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1923–1924

Tenth Evening Meeting, 24 March 1924. The President in the Chair.

ELECTIONS.—Donald Ferlys Wilson Baden-Powell; Miss Edna Bown; Miss Minnie Charlton, B.A.; Major-General H. A. Cummins, C.B., C.M.G.; J. Graham Dawson; J. W. Dix; Michael Arthur Unwin Heathcote; Alexander Hepburn Macklin; Squadron-Leader James Milne Robb, D.F.C., R.A.F.; James W. Thirtle, LL.D., M.R.A.S.; Captain J. Pulteney Tolland; Franklyn Lewis Turner, C.B.; Captain Claud Francis Webb; Kenneth Jobson Yeomans, B.A.

PAPER: Northward of Greenland. Dr. Lauge Koch.

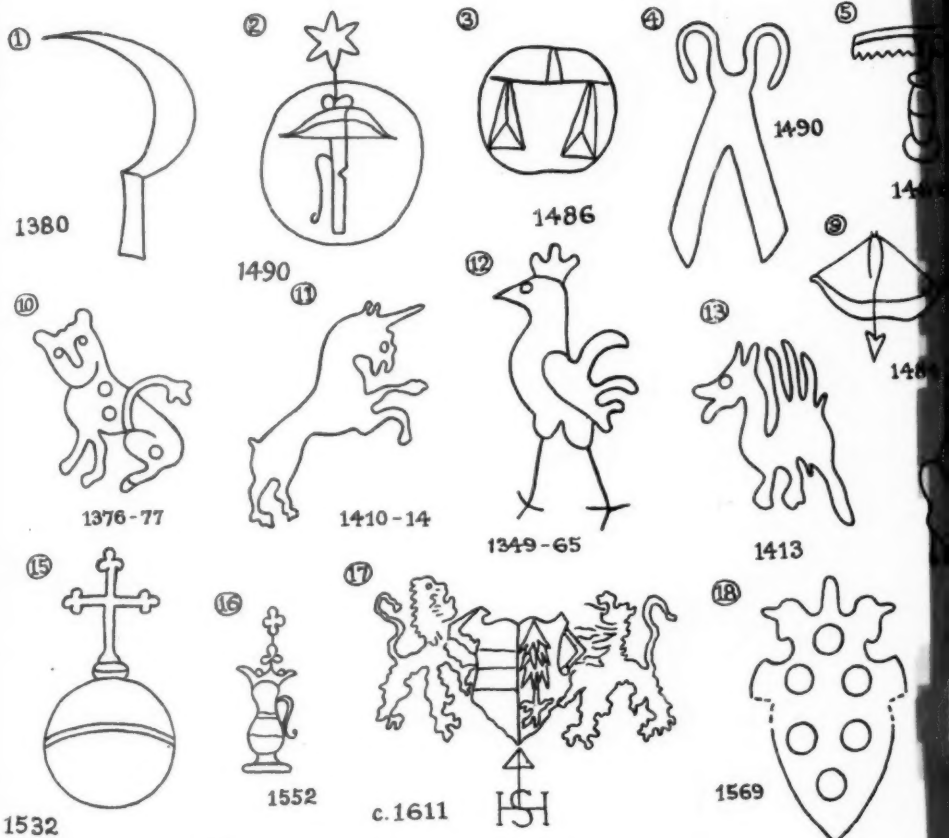
Eleventh Evening Meeting, 7 April 1924.—The President in the Chair.

ELECTIONS.—Captain R. E. Alderman, C.I.E., O.B.E.; Commr. Melville Henry Bloomer; Archibald Evelyn Brown; Arthur Browne; Thomas Butler, J.P.; Sydney Cliff; His Excellency Señor Dr. Don Luis Cuervo-Marquez; Eden Rowland Huddleston Dicken; H. Fairhurst, M.A.; Clarence Stanley Fisher, SC.D.; Charles Warwick Fleming; H. W. M. Harvey; H. G. Houlding; Ronald Stephen Lockwood; Mrs. Constance Mary Long; Rev. John Hill Martin, M.A.; James Maxwell Moddrel, F.I.C.S.; Mrs. W. Moffat; Captain Victor Gordon Oldacre, I.A. (Rtd.); Hon. Richard Sims Donkin Rankine, C.M.G.; Captain W. T. Cecil Riley; Rev. Arthur Birch Sayce, M.A.; Henry de Vere Stacpoole, J.P.; Richard Lightburn Sutton, M.D., LL.D.; Lieut.-Col. J. Ramsay Tainish, V.D.; Miss Annie Jane Wright.

PAPER: On the Western Frontier of the Sudan. Captain P. K. Boulnois.

Sixth Afternoon Meeting, 14 April 1924.—The President in the Chair.

PAPER: Climatic Continentality and Oceanity. David Brunt.



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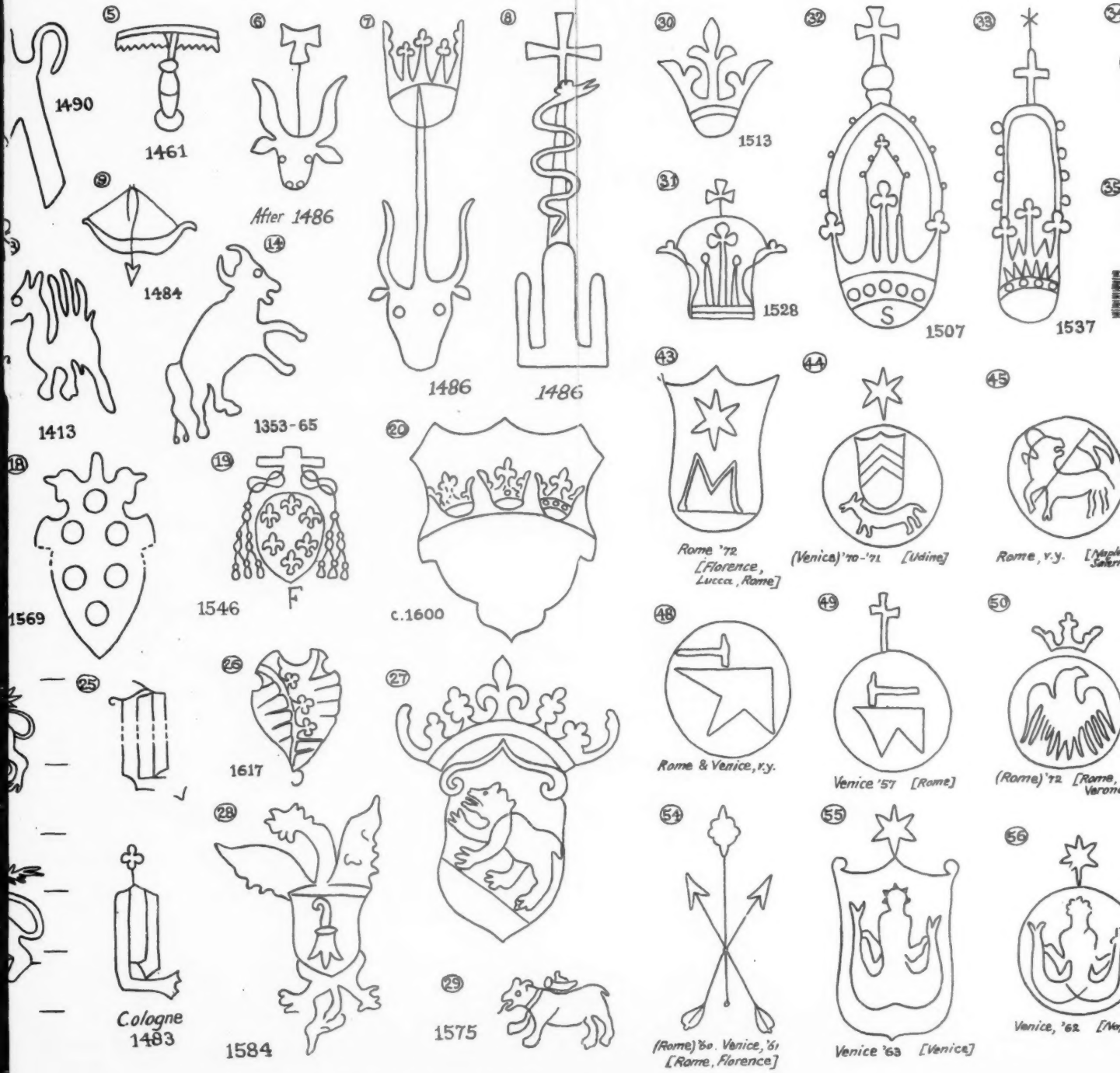
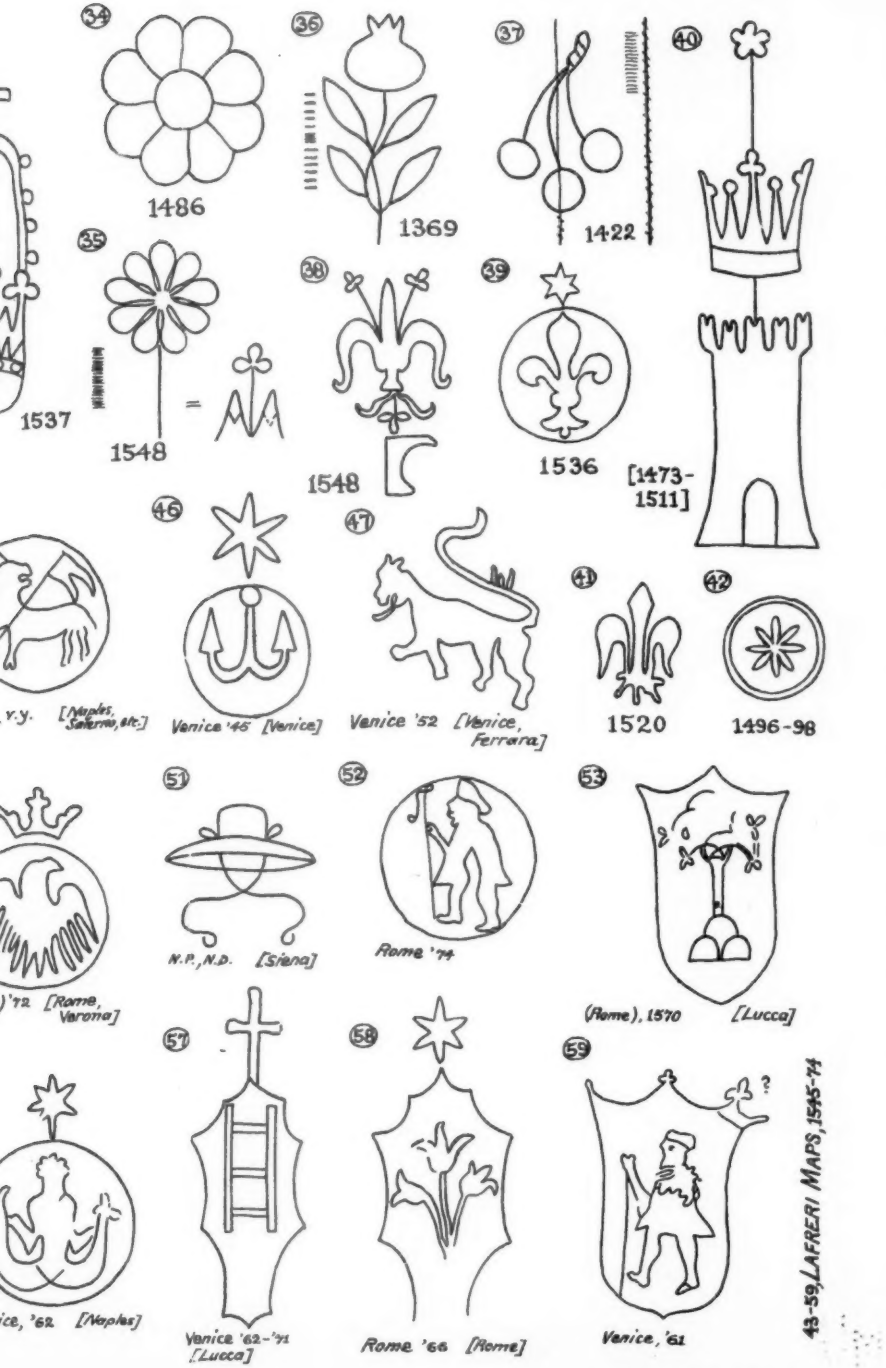


Published by the Royal Geographical Society



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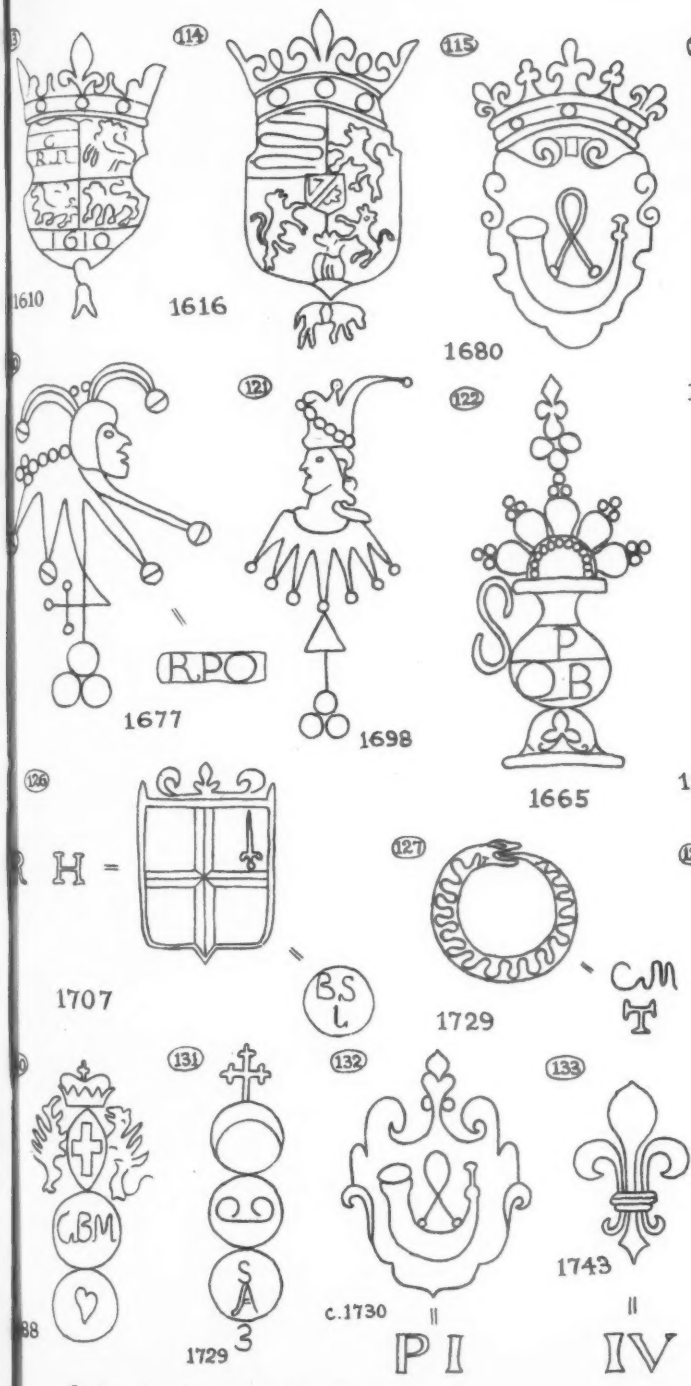

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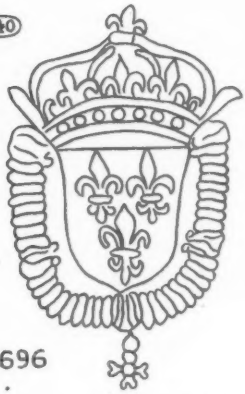
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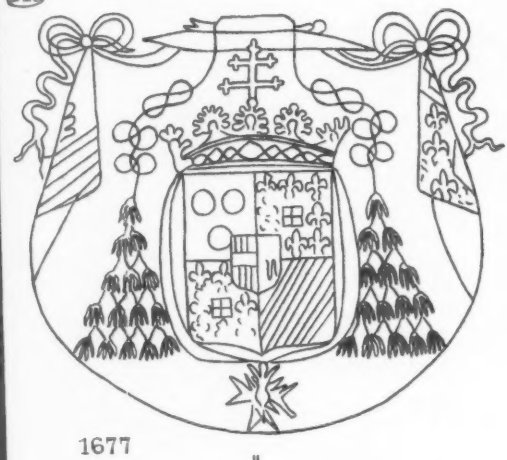
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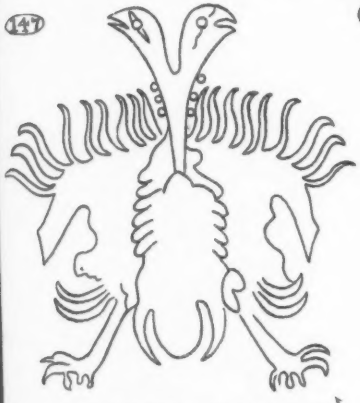
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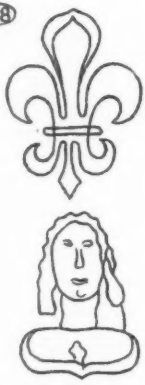
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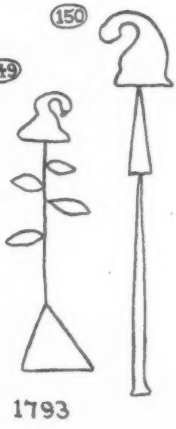
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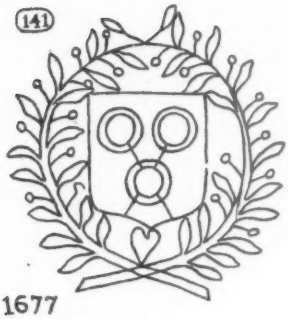

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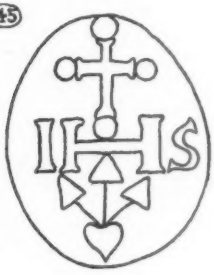

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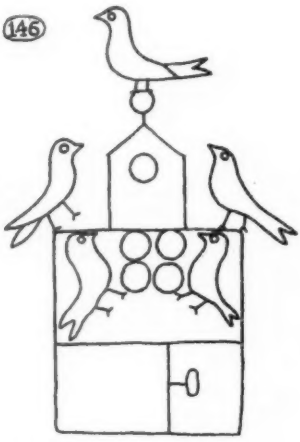

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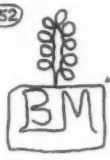

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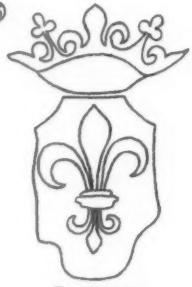

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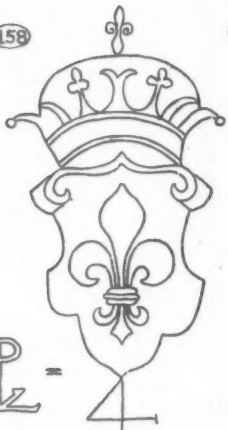

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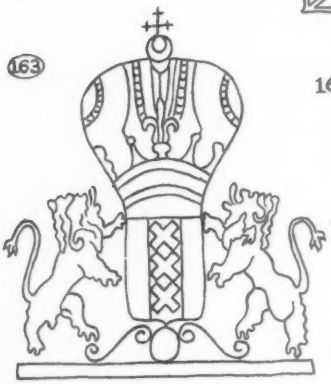

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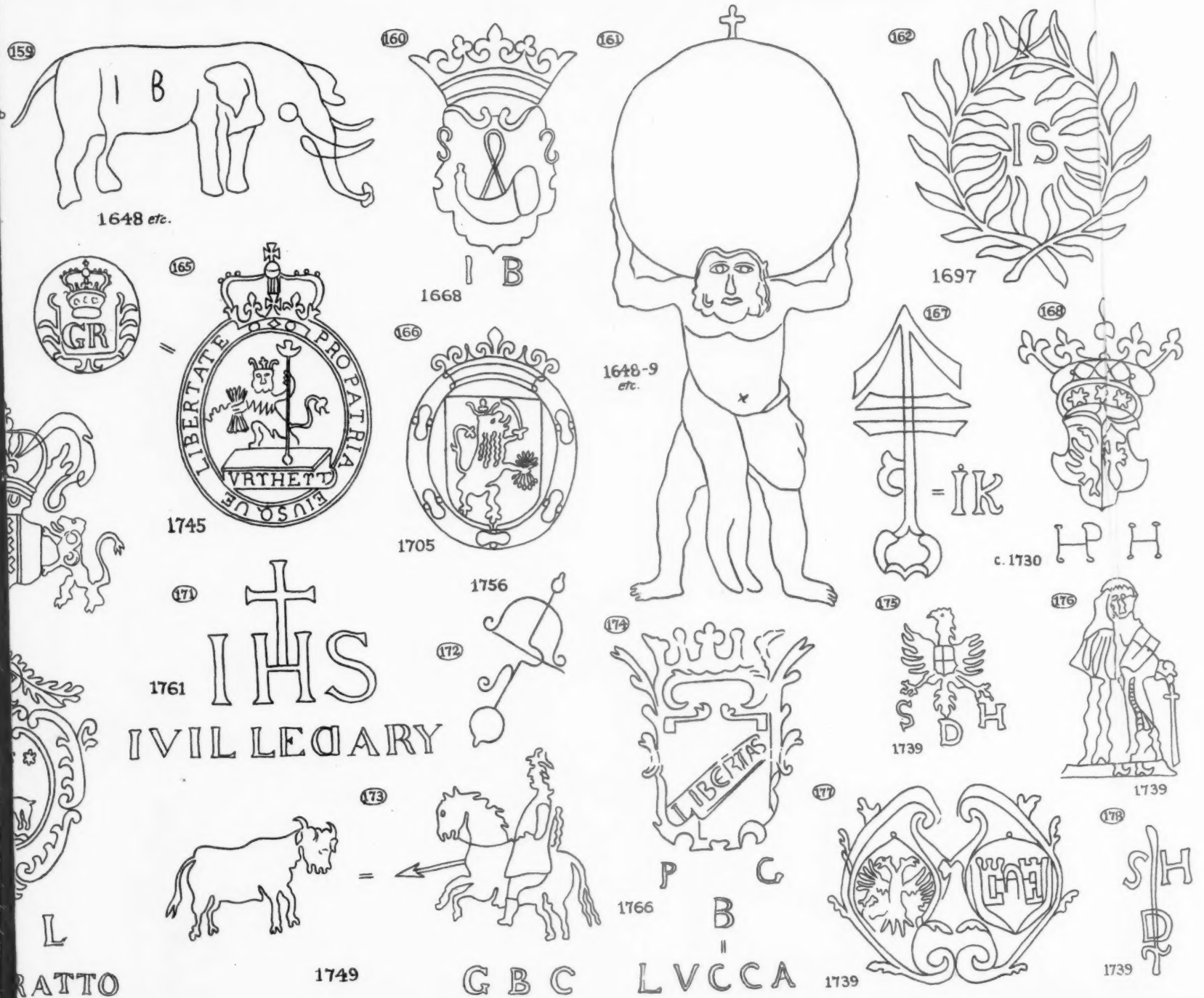
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